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EDITORIAL NOTES.

The Meeting of the Institution of Gas Engineers—The Need for Reunion.

THE meeting of the Institution of Gas Engineers was held last week, under the presidency of Mr. Thomas Holgate, of Halifax, and proved fruitful of much valuable technical instruction. Credit for a large share in this eminently desirable result must be given to the President, whose address was replete with information. The papers as contributed to the meeting by Mr. H. E. Jones and Mr. A. F. Browne, and the remarkable performance of Mr. Livesey, would distinguish any professional gathering. The meeting was not particularly well attended, nor was the annual dinner very successful in the same respect; but the visit to Cambridge on Friday was participated in with a degree of appreciation that must have been extremely gratifying to Mr. R. Brown, the Engineer of the Cambridge University and Town Gas Company, whose fine carbonizing plant on the inclined system was the chief technical attraction. Thus, on the whole, those members who were able to attend the meeting had no possible reason to complain of the manner in which their time was spent.

A very important point in the Institution proceedings had reference to the endeavours that have been so long in progress with the object of reuniting the profession in a single national organization. In regard to this matter, some observations of Mr. Livesey's, made with his usual unconventionality of phrase, might be taken amiss if too literally interpreted. It will be better for us to refer the reader to Mr. Livesey's words as reported; but there is really not the smallest difficulty in understanding what it was he meant. As machinery for procuring technical papers and providing opportunities for discussing them in the light of experience gathered in all parts of the country, and also for bringing the members of a peculiarly scattered profession into social converse at regular intervals, both the Institution and the Gas Institute subserve a very useful purpose. With this, however, it is incontestable that their usefulness practically ends. Between the meetings there is no effective organization, such as might be set in operation to the purposes mentioned by Mr. Livesey. If there is anything of the kind to be done, it falls to somebody to do it, irrespective of either Institution or Institute. Nor is this the only respect in which the ineffectiveness of the imperfect and divided national representation of the personal forces of the gas industry shows itself. On such occasions as an engineering congress, a special representative body *ad hoc* has to be created, with the inevitable aggravation of the existing division by considerations of who is to occupy the first place, and who is to come second. The whole of the important and pressing business of technical education stands in abeyance for precisely the same reason. Not the smallest point of doubtful practice—such, for instance, as standardization—or an investigation like that which the Southern District Association have taken in hand, can be tackled with all the strength of the profession. Meanwhile, there is much waste of effort, time, and money. The working expenses of two technical Societies and of a Gas Companies' Protection Association have all to be defrayed. Secretaries and clerks, offices, printing, council meetings, and other charges, have to be paid for two or three times over; and they must, moreover, be stinted in every case, although the gross expense must be hundreds of pounds a session. The money alone which is wasted in this way would suffice to pay a thoroughly good secretarial staff, who would be useful oftener than for two or three days in the year; and the gas industry of the country would have a fulcrum for combined effort which is now altogether lacking.

For these and other reasons which might be stated, if the case were not really agreed upon the point of the principle, union in the profession is not only desirable, but is absolutely essential, unless the organization of the leaders of the gas industry for its greater good is to be given up as an impossible dream. Such a conclusion would not be creditable either to the good sense or the right feeling of the possible constituents of a satisfactory and effective society; but we cannot conceal from ourselves or from our readers that the prospect of its avoidance is not bright. Nobody appears to be at all keen upon a complete reorganization of the profession. Those who would be offended at Mr. Livesey's outspokenness would confess thereby that they have no real desire to rise to better things. To such, if there be any, who are contented with the actual state, not only of the two Societies, but also of the District Associations, there is no more to be said. Let those, however, who are possessed with a reasonable discontent with the frittered and divided condition of the industry's forces, take care lest the obscurantism of some among them works out to the perpetuation of a weakness on the part of the members of the profession, which all would deplore. The call of the Prince of Wales to England to "Wake Up" appeals with special appropriateness to our national gas industry. There is not a country in the civilized world which has a gas engineering society that is not better served in respect of having a working organization than the land which originated the industry. They are all ahead of us, and are leaving us behind. If this is to remain true of the British industry, at least those who are to blame for it should perceive what it is they do.

The really noble efforts that are being made by some of the American Gas Associations put our apathy and heedlessness to shame. The French Society occupies a peculiar position, inasmuch as it acts as dispenser of rewards to meritorious gas workers, according to a fashion which is of quite venerable antiquity. The German Association is really a tremendous institution, guided by the brightest intellects of the Empire in their line. And all these things bring their recompense. There is a tingling technical activity in Germany which translates itself into public services of wide range and remarkable variety. The central organization is as the brain which corresponds, by means of nerves, with every part of the scattered membership, which in turn communicates with the centre. The day has long passed when British gas engineers could teach either Germans or Frenchmen anything; but it is not too late for us to teach ourselves more thoroughly than we have ever attempted to do before. That the personality of the British gas industry and profession should rest divided, and therefore ineffective, in the present state of the world all round it and within, is so heavy a reproach, that the decision cannot be long postponed of those who are already half disposed to think it better to give up the pretence of organization altogether than to go on playing at it by coteries.

The Trade Unionists' Dilemma.

THE Management Committee of the General Federation of Trade Unions have for some time past had under consideration the effect upon the position and liabilities of Trade Unions of the House of Lords judgment in the Taff Vale Railway case, and have now issued to the Unions comprising the Federation a lengthy report upon the various suggestions that have been made, with a view to enabling Unions to free themselves from financial liability for the wrongful acts of their officers and members. The report takes a very pessimistic view of the situation, rejecting every suggested expedient as not affording reliable security against the forfeiture of funds. The Committee do not think any alterations of rules could be confidently relied upon, and point out that the carrying through of such alterations would be an expensive matter. The separation of the "friendly" funds from the war-chest, which has been often urged as a solution of the problem, is rejected on two grounds. The one is that the Unions must always keep a working balance in hand; the other, that it is uncertain whether any separation of the funds would avail against a verdict with damages. For it is problematical in the extreme whether the Unions would care to so separate their funds as to make it absolutely impossible for them to use the sick and superannuation balances when the war-chest was exhausted by a strike or lock-out; and a division of the funds which left any

loophole for the use of the "friendly" balances to bolster up a strike, would be very doubtful security against a judgment giving damages against the Union.

The proposal, made by the Labour Commission, for the incorporation of Unions so that there could be no question as to their being able to sue or be sued, is not viewed with favour by the Committee. It would mean practically the throwing of the Trade Union Acts of 1871 and 1875 into the melting-pot; and the Federation do not feel sufficient confidence that what would be taken out of that pot would be, on the whole, as favourable to Trade Unionism as what was put in. The nation has had about thirty years' more experience of Trade Unionism since those Acts were passed; and the "New Unionism" has come into being in the interval. With the rise of foreign competition in out own home and foreign markets—which was a negligible factor until some years after Germany had received and spent upon her industrial development the huge war indemnity paid her by France—the detrimental influence of Trade Unionism upon our industrial position in the world has become more clearly apparent to thinking men. For this reason, we feel pretty confident that the course finally recommended by the Federation in its despair—namely, that of bringing before Parliament a Bill to relieve Trade Unions of the liability they recently discovered they are under—will receive very little support indeed in the House of Commons.

In addition to recommending that picketing with "peaceful persuasion" should be explicitly legalized, the Committee recommended that a one-clause Bill should be submitted to Members of Parliament, with a request for their support, enacting that: "No action shall lie against a Trade Union for the recovery of damage sustained by any person whatsoever by reason of the action of a member or members of a Union, or persons acting on his or their behalf, unless it be proved that such member or members or persons acted with the directly-expressed sanction and authority of the Trade Union rules." Those rules would then, of course, be drawn up on the "Don't nail his ears to the pump" plan. A very pretty scheme, no doubt; but one not likely to receive the sanction of a Legislature that is entrusted with the care of the interests of all classes of the nation, and has old-fashioned notions of the meaning of equity. It is presumably with a view to modifying the attitude of Parliament towards such matters—and, incidentally, with an eye to their own personal aggrandisement—that the Trade Union leaders are pushing so persistently their idea of a big fund, subscribed by Trade Unionists throughout the country, for the purpose of securing the election to Parliament of more Labour Members. But it is interesting to note, in this connection, that the enthusiasm displayed by the leaders and delegates—who doubtless have mental visions of their names in print, with the magic "M.P." appended thereto—is not reflected by the rank and file, who are asked to provide the money and see no chance of sharing in the glory. At a district meeting of the South Wales Miners' Federation recently, several delegates reported that there was a "growing dissatisfaction" among the men at having to pay the levy. The leaders want to call the tune, while leaving their followers to pay the piper; and the followers do not quite see where the fun comes in.

If it is possible for the Unions to obtain relief from liability for compensating the victims of their persecuting tactics, they had better be quick about it. If not, they had better make similar haste to drop those tactics; for the victims are losing no time in claiming compensation. Following upon Giblan's action against the Amalgamated Labourers, and that of Thomas against the Society of Carpenters and Joiners, comes that of Lewis George Read against the Friendly Society of Operative Stonemasons. This Society is alleged to have shown its "friendliness" by forcing Read's employers to reduce him from the rank of apprentice (which he held under agreement with them) to that of labourer at 15s. a week, from which he had been promoted; thereby preventing him from qualifying as a journeyman stonemason at 35s. a week. The County Court Judge held that Read had no cause of action against the defendants, who "seemed to have acted *bonâ fide* in the interests of the Society, and were not actuated by improper motives." But on Saturday last the Lord Chief Justice, with Justices Darling and Channell, sent the case back to the County Court for re-trial; holding that it was not enough, to justify the conduct of the defendants in inducing plaintiff's employers to break their contract with him, that they acted *bonâ fide* and with proper motives, or that they honestly acted on a wrong understanding of the rules of the Society to which the employers had subscribed. The way of the Trade Union transgressor of the law is becoming unpleasantly hard; and the Federation Committee report that it is not easy to find a feasible scheme for softening it.

The Price of Coal.

THE important question of the price of gas coal during the ensuing twelve months—that is to say, in its connection with contract purchases—may be said to be now settled so far as the requirements of London are concerned; and the range of prices throughout the country may be pretty accurately gauged. Broadly speaking, the two great London Gas Companies have bought their supplies, or, rather the bulk of them, for the next twelve months, at the same average price as they paid during the contract year that in the one case has already expired, and in the other will expire at the end of June. If anything, there is just the shade of advantage with the Companies—freights being extremely low; but the coal itself, if our information be correct, is not appreciably cheaper, though much, of course, depends upon quality. When it is remembered that 400 feet of gas, one way or the other, in the production of the ton of coal (to say nothing of the quantity and quality of the residual coke), makes a difference of about 1s. per ton in its value, the impossibility of being certain of the exact net price one will be paying for coal bought under a twelvemonth's contract becomes apparent. To put the difference in value between some of the coal that the London Companies paid 20s. a ton for in the spring of 1900 and that which they are now paying for at the rate of 12s. per ton, at the difference between those prices, would, as many of the Works Engineers would testify, be very wide of the truth.

In Lancashire, one of the largest gas-works has completed its contracts at 1s. per ton below last year's prices, which were, however, only 2s. 6d. per ton below the top prices of contracts in 1900—and those contracts were 5s. above the former level. The Edinburgh Commissioners have obtained a considerable reduction upon the rates paid under expiring contracts; but here, again, it must be noted that the concessions obtained last year were not proportionately so great as those which the London Companies succeeded in getting out of the Durham collieries. Nowhere, in fact, have prices yet got back to the level of 1895-6; so that there will be room for further concessions next year. This settlement is not so satisfactory as could have been wished, nor so favourable to buyers as six months ago might have been anticipated. But so soon as the output figures for 1901 were published, the otherwise inexplicable maintenance of coal prices at or above the level to which they fell last spring was shown to be due, as we had for some time suspected, to reduced output; and it was evident that no great fall in prices was to be anticipated.

The lessened output, as we have frequently pointed out, is largely a question of wages. When they have fallen to a more reasonable level, the output will doubtless show decided signs of expansion. We are glad to be able to note, at last, a move in the right direction in regard to wages in the Federation area, where there have been no decreases, but only increases, in the rates of pay since August, 1894. Wages were then reduced to the minimum settled by the Conciliation Board—viz., to 30 per cent. above the 1888 standard—and remained at that level until the end of 1898, when they stood at 32½ per cent. By the 1st of October, 1899—the beginning of the "coal famine"—Federation miners were receiving 40 per cent. above the standard. In December of that year, the owners agreed to give a further 5 per cent. as from the 1st of January following—this bringing the rates payable up to the then existing maximum. At the same time, it was agreed to extend the term of existence of the Conciliation Board until the end of 1903, and also to increase the maximum rate of pay from 45 to 60 per cent. above the standard. In October, 1900, wages were raised to 50 per cent., and then, by 5 per cent. in January and again in February, 1901, to the maximum of 60 per cent. above 1888 rates. At that maximum, in spite of the great fall in the price of coal, wages still stand; but on Thursday last the Conciliation Board met, and the men's representatives, after much discussion, agreed to recommend their constituents to accept a 5 per cent. reduction as at the first pay-day in June, and a further 5 per cent. reduction two months later.

These reductions, which there is every probability that

the men will accept—they have absolutely no grounds upon which to refuse—will then leave the rates of pay at a level (50 per cent. above standard) higher than the maximum fixed nine years ago, after the great strike; so that the men will still be receiving exceptionally good wages. But, while it is doubtful if the reduction is sufficient to stimulate output, the move is in the right direction, and is therefore welcome to coal buyers. The great wave of prosperity in the coal trade did not last very long, though it lasted a great deal too long—long enough to do great damage to business; but its effects have been far reaching, and are still being felt. What is to be feared is that the ebb will not be finished without serious labour troubles; but it is a subject for congratulation that so far they have been avoided. The possibility must not, however, be overlooked when the question of stocks of coal with which to commence the next winter season comes under consideration.

Consumers' Agreements.

THERE has been disposed of by his Honour Judge Emden, at the Lambeth County Court, a peculiar case, which should receive the particular attention of suppliers and consumers of gas and electricity. It was an action brought by the South London Electric Supply Corporation against one of their ex-consumers named Bell, to recover £1 3s. 4d. in respect of electricity supplied. Defendant said he had been canvassed by a representative of the Corporation, and admitted signing a document which he understood to be an agreement to take the electric light up to the ensuing Michaelmas of 1900. At the end of this period, he wrote asking the Corporation to take the fittings away; giving as his reason that he found gas to be better. He told the Judge he could get more light from one incandescent burner "than from the whole six of these—16-candle power they "call them." Thereupon the Corporation replied that the agreement had been signed for three years. This the consumer denied, and asked to see the agreement, of which he had no copy. When the document was at length produced in Court, it was found to have the words "and this agree-"ment shall be operative under any circumstances for a "period of not less than three years" upon it in very small type, having been added after the rest had been printed. The consumer was sure that the addition must have been made subsequently to his signing the paper. So grave an accusation greatly complicated the case; and the Corporation very properly produced evidence to the contrary. In the event, however, the Judge was relieved of the painful duty of deciding on so delicate a point, because the agreement was found to contain a notification that the consumer's tenancy of his house expired at the date of his discontinuance of the electric light.

The importance of this case lay in the Judge's remarks on the lax way in which the Electric Light Company did their business. He objected to the insertion in the agreement of an important clause in small print—in a place, too, where no one would expect to find such a thing. This was a question of the printing, and might not arise again. He thought, moreover, that consumers ought to have a counterpart or copy of their agreement, so that they might know to what they had bound themselves. Most important of all, however, his Honour held that a consumer cannot bind himself for a longer term than his tenancy; so that no clause of an agreement contrary to this limitation is valid. This is a highly important consideration for companies doing business upon the hire-purchase system. In this case, the Corporation had wired the consumer's premises; and, as the Judge said, they might reasonably bind him for a term on this account. But it could not be for longer than the man held the house. The Secretary of the Corporation said they hoped the tenant would renew his term; but the Judge put this consideration aside as irrelevant. Seeing, therefore, that many houses are occupied on a three years agreement, of which some period must have already elapsed when the Corporation's canvasser comes round, it is clear that there must be a very great risk in this hire-purchase business. With regard to gas consumers' agreements, which are still insisted upon by some suppliers, the remarks of Judge Emden as to furnishing the consumer with a copy should have weight.

In the Cause of the Brightness of English Streets.

THE subject of the lighting up of the streets of English towns by concerted action between the architects of the frontages and the purveyors of the actual public lamps, has been so often touched upon in these columns that, when we learnt Mr. Beresford Pite, F.R.I.B.A., was to read a paper on "Street Architecture" before the Society of Arts, we experienced a certain amount of curiosity as to whether the eminent architect would say a word about the lighting. It was with no very acute feeling of disappointment, however, that we perused the report of Mr. Pite's paper in the "Journal" of the Society, only to find he had not a remark to make about it. For some inscrutable reason, architects never seem to recognize for a moment that street lighting is half the charm of any thoroughfare which is a place of public resort after dark. It would be too much to expect them to know anything about the lighting itself, or the style and disposition of the lamps and standards. All this has to be seen to by the very inartistic persons who serve the public in the capacities of highway surveyors and gas engineers. It was only by the barest chance that Vulliamy's "dolphin" lamp-posts on the Victoria Embankment were not sent to the scrap-heap, to make way for electric lamp standards of the London County Council style of design, such as may be seen on Waterloo Bridge. The architects would not have interfered. But what strikes us as so odd, and such a dereliction of duty on their part is, that they do not think of the connection between the character of a street frontage and the effect of artificial light in the street.

With an obvious effort, and as though patting himself on the back for his liberality of judgment, Mr. Pite admitted that architecture of the ecclesiastical and country-house class could not expect to dictate to those commercial employers of architects who want shop-fronts. Architects of the academical variety are always groaning over the plate-glass windows they have to admit for the ground-floor fronts of business premises; and Mr. Pite properly tells his professional brethren that they must put their academical prejudices into their pockets, and make the best of plate-glass and iron frontage construction. "A whole-hearted acceptance "of the doctrine of a frank modernism of design and con-"struction in business premises by architects, is sufficient "requirement to make of them for the establishment and "the growth in our midst of healthy street architecture, "expressing the movement of the age in its requirements, "and reflecting the intellectual attitude of trained and "artistic minds applied to a commercial problem in build-"ing." That is very sound advice, so far as it goes. But Mr. Pite ventures farther. He will admit the new "half-"steel" and concrete construction to as great a respect as its exact forerunner, "half-timber;" and he sees nothing to be ashamed of in rivet-heads and the other details of built-up girder and stanchion work. Yet he is fain to confess that "few architects have as yet had the courage to work out "an iron architecture (say) with glazed brick, terra-cotta, "stone, or concrete fillings." The only point at which Mr. Pite approached the lighting question was where he unreservedly admired Regent Quadrant, "new-made annually "with fresh paint." It will come to this, after all. The brightness of these painted frontages of the Regency period will shame the gloom of portland stone, and terra-cotta the colour of congealed blood. Even now, the Grand Hotel is being painted, greatly to the benefit of the decorative lighting of what is London's only approach to a boulevard.

Autumn Meeting of the Institution of Gas Engineers.

The President of the Institution of Gas Engineers (Mr. Thomas Holgate) has given the members information betimes as to the projected arrangements for the autumn meeting. As will be seen from our account of the excursion to Cambridge last Friday, he took advantage of an opportunity afforded after the luncheon to make an announcement on the subject; but, of course, at this early period, his statement must only be regarded as an outline of what is contemplated. It is proposed that the members should visit the President's town of Halifax in the first week of September; and probably the arrangements will extend over two days. The programme that the President has in mind is a visit to the gas-works the first day, with a dinner in the evening; and the second day, a drive to the new water-works in the Washdean Valley. The Chairman of the Gas Committee and his colleagues will do their part in making the visitors comfortable and their stay as enjoyable as possible. Brief as is this preliminary announcement, it is very inviting; and members will do well to make a note of it, and settle their engagements accordingly.

Devonport Gas-Works Transfer.

The transfer of the Devonport gas undertaking from the Company to the Corporation took place last week. There still, however, remain some few questions in dispute between the two bodies, and these are likely to engage the attention of the Courts. The Act of last session under which the Corporation acquired the undertaking provides that the transfer should take place on the 31st of December, and that if it were not then completed the Corporation should pay interest on the purchase-money at the rate of 4 per cent. Difference of opinion is now found to exist as to which of the parties should have the sums collected for the sale of gas and residuals up to the date named. The Company claim these receipts in full; while the Corporation contend that for the period ending as above named the Company are entitled under the Act to only pay themselves an amount equal to the maximum dividend, provided such dividend was earned, and that this is borne out by the terms of the award as to debts and liabilities. The sum in dispute is nearly £13,000. The Corporation proposed to pay the amount into Court, in order to avoid further delay in the settlement, which was involving a charge of about £100 a week in interest. It was, however, agreed that the Corporation should give a cheque for the amount of the purchase-money—£149,000—less the sum in dispute, and that the acceptance of this sum should not prejudice the Company's right to sue for the balance. Another and smaller point affects some of the consumers, for the Corporation announce that those who had made deposits with the Company must look to the Company for the repayment of them.

The End of the Morecambe Gas Company.

"The Winding Up of the Morecambe Gas Company" might be a somewhat startling headline to anyone not acquainted with the affairs of the industry; but happily gas companies are very different from many others, inasmuch as their winding up is generally a most satisfactory business for all concerned. The Morecambe Gas Company have sold their undertaking to the District Council for £141,000 (the Company to retain the amount of the reserve fund £2153 and the balance of profit and loss account £2925), which has allowed of a return at the rates of 220, 413, and 515 per cent. to the holders of the various classes of stock. Besides this, a sum of £240 was distributed among the officials and servants, £2000 was paid to the Secretary and Manager (Mr. W. Duff), £2000 to the Directors, and £50 to the Auditor, a silver tea service was presented to Mrs. Duff, and a donation of £105 was to be handed to the Morecambe Cottage Hospital. Those connected with the Company have therefore the greatest reason to congratulate themselves on the result. From the point of view of the Council, however, the transfer has not so far turned out to be all that was expected; they have had to pay more for materials, and a heavier amount of interest than was anticipated on the money they have had to borrow. But these can only be regarded as temporary difficulties The town have purchased a sound commercial undertaking; and with a return to normal conditions, they will doubtless realize a good profit on their investment. At any rate, the Council can have no just cause of complaint, seeing that the price for the works was fixed by three very well-known engineers, two of whom acted for the Council and one for the Company.

Prepayment Meter Law.

The Workmen's Compensation Act would be hard to beat in regard to the many interesting points it has caused to be raised for judicial decision; but it seems as if the prepayment meter will at any rate be a good second in the running. Now that this form of meter has assumed such vast importance in the work of gas supply, it is absolutely necessary that it should be placed in as unassailable a position as possible. The cases which come before the Courts are thus of much more than local interest, and should be carefully noted by all gas managers, for sooner or later each one will in all probability have precisely the same questions to contend with. All cases possessing special points are duly recorded in our pages, and this week there are three of them. Two of the disputes arose through breaches by consumers of signed agreements. At Chester, a man left his house (and his meter) without advising the Gas Company of his intention; and on the officials finding the machine damaged, and the money in it less in amount than it should have been, the offender was summoned. He thereupon denied that he had signed the agreement which bore his name; and eventually it was elicited that his wife had filled in the name without informing her husband of the fact. She was, however, held to be his agent, and the consumer was ordered to pay. In the case heard at Longton, an order was made for the payment of 19s., the value of gas shown to have been used by a consumer. It was admitted by the Corporation that a robbery had taken place on the premises; the meter having been broken open and the contents abstracted. But the Magistrates held that until the money deposited in the meter was actually in the hands of the Corporation or their collector, the consumer was responsible for its safe keeping. In this instance, no agreement had been entered into. Both these cases seem a trifle hard on the consumers, though the principles involved are of cardinal importance to gas suppliers. More may, however, be heard of the second one, as leave to appeal was granted.

Conspiracy and Protection of Property Act.

More than a quarter-of-a-century ago there was passed the Conspiracy and Protection of Property Act, the fourth section of which renders liable to heavy penalties persons employed in gas or water works who wilfully break their contracts of service. The reason for gas and water undertakings being singled out for this special protection is perfectly understandable, when one considers the great gravity of a sudden cessation of the supply of either one or the other. The prime object of the Act, of course, was to prevent the public from being put to such danger as would result from this stoppage, and not merely to put a weapon into the hands of employers. Some members of the Glasgow Corporation, however, appear to think otherwise; for at their meeting last week a proposal was brought forward that the Parliamentary Bills Committee should be instructed to consider and report upon the advisability of petitioning Parliament for the extension of the provisions of the Act to other departments of the Corporation and of other municipal authorities. Had the suggestion been confined to the Lighting Department (which is separate from the Corporation Gas Department, to which, of course, the Act applies) and the Electricity Department, there might have been a good deal to be said in favour of it; but the inclusion of the tramways would be difficult to justify on the grounds of public safety. The separation of the Gas and Lighting Departments, by which the lamplighters are removed from the scope of the Act, is in a way exceptional; and electric light has only in recent years become a factor worth consideration as regards its sudden cessation being a matter of very serious public inconvenience. However, the majority of the members of the Corporation were of opinion that such an extension of the provisions of the Act would not be advisable, even if they could get it. It was urged by one gentleman that all disputes might be avoided if only the Corporation were judicious enough to consider the claims of their employees in a fair-minded spirit. Unhappily, this is not the universal experience; for it is not always the men who are most considerately treated who pay the greatest attention to their master's interests. If such were the case, the cares of many an anxious employer would immediately disappear, and the men themselves be much the happier for fully understanding how well off they are.

The Need for Advertising.

It was only last week that we remarked upon the desirability of the advantages of gas being brought to the attention of the general public; and some of our readers may be wondering how best this can be done. Well, if they were members of the Ohio Gaslight Association they would receive assistance in this very practical matter, for the Association possess such a generous idea of their functions that they have included a Novelty Advertising Department, the Editor of which, at the recent annual meeting, submitted a report comprising seventeen items. We must confess that one at least of the suggestions comes upon us with something approaching a shock. Fancy the idea of placing sky signs on the tops of gasholders—as if gasholders of themselves were not ugly enough, without any addition of this kind! It is to be sincerely hoped that this proposal does not meet the eye of one or other of the many enterprising vendors of patent medicines or wonderful soaps, or the result may be only too awful to contemplate. But though all the

methods may not commend themselves, it would be strange if the seeker after a novel means of advertising did not find among the many suggestions something to his taste, and thereby derive substantial benefit from the efforts of the Association in this direction. Perhaps, however, the very best recommendation a gas company can possess is a character for treating the consumers well; and in order to retain the good opinions of customers, it is above all necessary that every complaint should receive prompt and earnest attention. How best to give this attention formed the subject of a discussion at the same meeting; and various useful suggestions were elicited. The members of the Ohio Association are practical people; and there can be no doubt but that their deliberations are productive of a considerable amount of good.

Another Mond Power Gas Scheme.

One would have thought that prudence would have led people to wait and see the results of the South Staffordshire Mond gas experiment before launching forth fresh schemes of a similar character; but there seems to be no idea of adopting so wise a course. As we have already briefly intimated, arrangements are at the present time being made for the establishment of a plant on the site of the old chemical works at Prestolee, in Lancashire; and it is expected that the next few weeks will see the commencement of building operations. A Syndicate has been formed to meet the cost of preparing the scheme; and within a week the £5000 required was subscribed three times over. Besides this, the capital of the Company (£200,000) is said to be guaranteed privately. There would thus appear to be no lack of faith in the ability of Mond gas to do all that is claimed for it. The Company is to be called the Lancashire Mond Power-Gas Scheme, and among their customers are expected to be many of the leading manufacturers of Bolton, Farnworth, and district. The site on which the Company are about to build consists of 21 acres; but not more than two-thirds of this will be immediately utilized, while 3 acres are to be used for the generating station of the Lancashire Power Company, who expect to take a large proportion of the gas. The proposal is to distribute the gas to such works as can be reached by private wayleaves, thus avoiding the necessity of an Act of Parliament.

The Gas Question at Dalton.

Three weeks ago we recorded the curious position of affairs with regard to the ownership of the Dalton-in-Furness Gas-Works; one party being desirous that the undertaking should be transferred to the Urban District Council, and the other wishful to preserve the present arrangement, by which the works are managed by a Committee of twelve, who are elected by rotation. It was expected that at the annual meeting the whole of the Committee would retire, so as to test the feeling of the town on the question; but in the result only three seats were vacated, as usual. The proceedings were conducted amidst the utmost disorder; but eventually three gentlemen opposed to the transfer were elected, and thus the question is settled in the same way as it was ten years ago. The whole arrangement is most curious; and the tremendous amount of feeling which has been aroused on the present occasion over the proposed transfer, proves that under certain rare conditions it is possible to induce people to take an interest in local affairs. We welcome such interest, even though it does lead to uproar; but it is quite likely that the Chairman of this year's meeting of "gas consumers, property owners, and ratepay-"ers of Dalton Proper" would have been better pleased had a calmer spirit prevailed.

Another Fatal Lamp Accident.

There has been another fatal lamp fire in London, since the one we noticed last week, and almost as dreadful. Several poor people were driven to leap for their lives from upper windows, with disastrous consequences, including at least two deaths. Here also the petroleum lamp, described as being made of glass, was in use upon the ground floor about midnight. The person to whom it belonged had left the room for a few minutes, and returned to find the lamp shattered and the table ablaze. By the time the firemen arrived, the staircase was alight, and the people in the upper part of the house cut off from escape, except by the windows. Of course, the staircase was one of those match-wood constructions which our Building Acts do not forbid, even in the case of tenement houses. It burnt like a match, and was put out as easily; but meanwhile the mischief had been done. There was no gas in the house; but the lamp which broke was only one of several in use, any of which would have proved equally deadly. The owner of the lamp naturally believes it "exploded;" and the short report of the inquest which is the only one we have seen, states that the Jury found that the fire was caused by the "cracking" of the glass reservoir of the lamp, and that "the use of low-flash "oil is a standing danger to the community." How the question of the flash-point was involved does not appear. As in the previous case, what happened probably was the overheating of the reservoir and its filling with a good deal of petroleum vapour at high temperature owing to the oil burning low at the late hour. The remaining oil was heated to over the firing-point at which it would burn without a wick; and with so many conditions forming a catastrophe, the smallest thing would have precipitated it. The flash-point is quite immaterial in such circumstances, otherwise than that a low-flash oil does not heat up the lamp so much as a high-flash oil, and is consequently safer.

WATER AFFAIRS.

The Progress of the Water Inquiry.

The second week of the inquiry into the Metropolitan Water Supply by the Joint Committee of the two Houses of Parliament was marked by events of the greatest significance in connection with this difficult question. It will be found, by the report of the proceedings which appears elsewhere, that the sitting of the Committee on Monday was devoted to a further consideration of the drawbacks, from the Water Companies' point of view, attending the method proposed by the Government for the transfer of the undertakings to the Water Board. The first witness called was Mr. J. T. Taylor, the Town Clerk of Harrogate, who gave particulars in regard to the purchase of the water-works by the Corporation in 1897, in connection with which Messrs. Alfred Lass, Wood, and Co. rendered valuable assistance. In that case, the award was made nearly five months before the transfer took place; the works being in the meantime carried on by the Company. Mr. W. B. Bryan, Mr. J. W. Restler, and Mr. Walter Hunter, the Engineers respectively of the East London, Southwark and Vauxhall, and Grand Junction Water Companies, followed. Mr. Bryan laid stress upon the difficulty which the new officials of the Water Board would experience in carrying on the business of the Companies from the appointed day, whereas there would be none whatever in the Companies managing the undertakings, as trustees for the purchasers, until the transfer was completed and the money paid. Mr. Restler's evidence brought out clearly the anomalous position in which the officials would find themselves by the proposals of the Bill. Mr. Hunter also dwelt on this matter, and cited a personal case very much to the point. He asked the Committee to relieve him and his fellow-Engineers from such an unhappy position as that in which they would be placed by the "unjust and unprece-"dented arrangement" proposed by the Bill, of having to "serve two masters." He held that the method of transfer laid down in the Bill would involve undue delay and detriment, not only to the Companies, but to the Water Board itself; and in cross-examination by Mr. Ram he specifically stated the reasons for the opinion he had expressed.

Mr. Littler then addressed the Committee on behalf of the Companies he represented, directing his remarks specially against the arbitration clauses of the Bill, which he characterized as the most "blundersome" which had ever been brought before Parliament. Out of dozens of cases of transfer, the promoters had not, he said, been able to produce a single instance in which procedure under the Lands Clauses Act, for which the Companies asked, had caused the slightest injustice. They were called upon to surrender their property as the victims of a fad, and not on account of any dereliction of duty; and therefore they claimed the most respectful consideration Parliament could give them. Mr. Pember and Mr. Baggallay followed in the same strain. Mr. Fitzgerald, in reply, dealt fully with the three main objections to the section of the Bill under consideration—viz., the appointed day, the arbitration provisions, and the payment in water stock. He suggested that some of the Companies' objections might be met by the postponement of the

appointed day for six months—viz., to Dec. 25, 1904; but for them to insist upon the application of the Lands Clauses Act was absurd. At the close of the learned Counsel's address, the Committee deliberated for a considerable time in private. The result was the announcement of the first important decision of the week. The Chairman stated that they would adhere to the principle of the appointed day, and to transference, if necessary, before payment; but they would be willing to listen to a proposal for an extension of the limit of time named in the Bill. With regard to arbitration, they keep intact the main provisions of the Bill, but suggest that any casual vacancy in the tribunal should be filled by the High Court rather than by the Local Government Board. The question as to the issue of water stock was reserved. Thus ended the first day's work.

On Tuesday the proceedings opened with a long examination of Mr. Lithiby, on behalf of the promoters, in regard to the constitution of the Water Board. He explained the circumstances which led the Local Government Board to come to the conclusion to proceed on some basis other than that proposed by Lord Llandaff's Commission. The principles underlying the scheme eventually selected were giving representation to the Metropolitan Borough Councils, the Urban District Councils in the water area outside London, the County Councils who were Metropolitan Authorities under the Acts of 1871 and 1897, and certain other bodies concerned with the sources of supply. The witness, in considerable detail, explained the system adopted to determine the extent to which all these authorities should be represented. It had been tested, he said, by various combinations of population and rateable value, and the particular arrangement decided upon appeared to have the balance of advantage. He admitted that the proposed Board was large, and yet a desire had been manifested to make it even larger, as more representatives had been asked for. It was necessary to have a good number of members, in order that the work might be carried on without undue burden. At the suggestion of the Chairman, the views of the London County Council on the subject of the constitution of the Water Authority were submitted; the first witness called being Mr. T. M'Kinnon Wood, the Chairman of the Water Committee. He condemned the Bill on the ground that it proposed a Board which would possess neither administrative efficiency nor representative character, and one, moreover, which would be fluctuating, and of too heterogeneous a character to ensure a coherent, consistent policy. It was quite impossible for the ratepayers to have effective control over such a body, yet it would have unlimited power of making up deficiencies of income out of the rates. He considered that the constitution of the Board violated the sound principles of local government and financial responsibility. He suggested that either the County Council should be the Water Authority for all London, or that a body should be constituted on the lines laid down in Lord James's Bill of 1896, or even on those recommended in the report of Lord Llandaff's Commission. With this clear exposition of the Council's views, the proceedings for the day closed.

On the following morning, Mr. M'Kinnon Wood was cross-examined on the subject of the constitution of the Board, and he maintained that under the scheme proposed by the Government every body would be in such an insignificant minority as to be comparatively voiceless. The next witness was the Parliamentary Agent of the Council, Mr. H. L. Cripps, who characterized the proposals of the Bill in the matter under consideration as contrary to the whole experience of the last century, which had led up gradually to the adoption of the municipal system. The trend of legislation during the past thirty years had, he said, been in the direction of transferring water undertakings to municipal bodies; and it would require strong arguments to adopt a new and untried plan. At this point the Chairman asked the Council's representative to indicate the definite proposal which they were going to put forward. Mr. Balfour Browne complied with this request by stating that, in the first place they wished to be constituted the Water Authority. He was informed, however, that such a proposition could not be entertained by the Committee. This being so, he fell back upon Lord James's Bill, as proposing a body which would be simpler and more workable than that suggested by the promoters; and he then called Mr. Shaw Lefevre to give his views on the matter. The witness expressed the opinion that his Lordship's scheme for a Board of 31 members, of whom 16 were to be appointed by the London County Council, was far preferable to the one before the Committee, and, though not an ideal arrangement, was the next best thing to the municipal system. Mr. G. F. Deacon followed. He thought the proposed Board much too large, and considered it would be unwieldy in practice. He would prefer 30 members at the outside. Mr. Balfour Browne then addressed the Committee, and asked them to accept Lord James's Bill *en bloc*. He acknowledged that there were in it some things which he did not like, yet he did not wish to alter it in any way. The Committee deliberated in private on the matters submitted to them, and then Lord Balfour made an announcement which took everyone by surprise. He said the Committee had decided by a majority to strike out of Schedule III. of the Bill the representation of the Metropolitan Boroughs, and of the urban districts and boroughs in Essex, Kent, Middlesex, and Surrey, other than the borough of West Ham; and they called upon the promoters to prepare a fresh schedule for a Board consisting of about 35 members, including a Chairman and Vice-Chairman, but without giving a majority to the representatives of any one county. The far-reaching consequences of this decision were at once appreciated by the representatives of the promoters, who asked for an adjournment over the next day, to allow of a consultation with the President of the Local Government Board; but this was refused.

The Committee sat on Thursday, and decided to retain Tottenham and Enfield within the limits of supply of the Water Board; the undertakings therein to be acquired at their true value, subject to arbitration. The case of the Barnet District Gas and Water Company came under consideration in this connection, as suppliers of water in part of Enfield; and a clause was brought up to meet it, which was deemed to be satisfactory. On the question of rating, however, which affected the Company, the Committee declined to come to a decision. On behalf of the Railway Companies, a clause was asked for under which they would have to pay only one-fourth of any deficiency rate—placing them in the same position as similar undertakings in the other great municipalities of the country. Mr. Fitzgerald objected, on the ground that the new clause would alter for the first time the rating law in the County of London, and give to the Railway Companies an exemption they never enjoyed. The Committee refused the application; and the further proceedings were adjourned till to-day.

It is scarcely necessary to emphasize here the importance of the Committee's decision on Wednesday. By it, as will be seen, they have cut out the vital principle of the Bill. In framing his measure, the President of the Local Government Board departed from the recommendations of the last Royal Commission by constituting an authority which would give to the Metropolitan Borough Councils a voice in the management of the water supply of the entire area; in fact, he regarded them as the best representatives of London, as the District Councils were of the outside areas. His proposal was severely criticized when it was made; but he endeavoured to justify it on the ground that it would give that real life to local municipal government which all were desirous of seeing. In carrying out this idea, he produced a Water Board which we always regarded as an unwieldy body; and he has now not only been requested to reduce its dimensions, but to alter its constitution in such a way as to absolutely destroy its main feature. In substance, he has been told to make it accord more nearly with the recommendations of Lord Llandaff's Commission, which were made before the Metropolitan Borough Councils were called into existence. To comply will, in a certain measure, be to acknowledge defeat; and yet it is rumoured that Mr. Long will consent to the amendment proposed. If so, it will be rather hard upon the Councils, who had no intimation given to them that they might receive the treatment meted out to them by the Committee. And it may be questioned whether that body were altogether justified in making so important a change in the principle of the Bill as they have done. This, however, and other matters, will probably be cleared up during the sittings of the Committee this week, and further reference to them may be deferred. Of course, the London County Council claim the decision as a justification of the line taken up by them for the past ten years, and as a recognition of the justice of their case. As far as the Water Companies are concerned, they have gained a point in the promise of the postponement of the appointed day; but beyond this they have nothing to boast about—the Committee having retained the arbitration clauses of the Bill.

INSTITUTION OF GAS ENGINEERS.

PROCEEDINGS AT THE GENERAL MEETING,

HELD AT THE

INSTITUTION OF CIVIL ENGINEERS,

APRIL 30 AND MAY 1, 1902.

Mr. THOMAS HOLGATE, M.Inst.C.E., of Halifax, President.

REVIEW OF PROCEEDINGS.

Fair, but cool, weather prevailed in London last week for the Adjourned General Meeting of the Institution of Gas Engineers, which opened on Wednesday last at the Institution of Civil Engineers, when there was a moderately large attendance of members, many doubtless attracted by the prospect that the Honorary Secretary, Mr. J. W. Helps, would make an important statement on the subject of the proposals for amalgamation of the Institution and the Gas Institute. To tell truth, there was not a great deal of attraction otherwise; the list of papers not being noticeable for brilliant promise of animated and animating discussion, with but one or two exceptions.

The chair was taken by the retiring President, Mr. W. R. Herring, who duly received, upon vacating the position, the well-deserved thanks of the Institution for his exceptional services rendered to the gas engineering profession of the United Kingdom in connection with the Congress Meetings of the autumn. Mr. Herring was favoured by Fortune in respect to his opportunity of distinguishing his presidentship on this memorable occasion; and he is allowed on all hands to have made the very best and most gracious use of them, to the general contentment.

The always-popular Honorary Secretary was in his place to make, as his first official appearance before the Institution, the expected announcement as to the amalgamation negotiations. He acquitted himself of the task with a tactfulness and urbanity which should of themselves constitute a happy augury of the ultimate success of the movement, which has no heartier sympathizer, we are assured. It did not appear, however, that the net result of what Mr. Helps had to communicate as being actually accomplished amounted to very much. He had no suggestion to lay before the meeting. A deadlock stood revealed when his carefully-studied words had been spoken; and the prospects of the reunion of the profession of gas engineering in this country looked as nebulous as ever, when Mr. H. E. Jones, who was well fitted for the enterprise, both by reason of his eminent position in the industry and his freedom from any previous entanglement in the long controversy, stepped to the rescue of the situation. His proposition was an eminently practical one, as will be seen by the text which we report elsewhere; and it was warmly seconded by Mr. J. L. Chapman, who represented the experience of the subject which Mr. Jones lacked. Mr. Hunt and Mr. Livesey also supported the suggested compromise, which, after a desultory talk, was adopted by the meeting without a dissentient. It may as well be mentioned here that a supplemental suggestion, intended to further lubricate the way to an amicable settlement, was proffered and accepted the following day; but with this the members evidently felt that they had done their part, and that, if amalgamation is to go through upon the recognized lines, the next step must be taken by the Institute. Meanwhile, perhaps, the less said about the matter the better.

The new President, Mr. Thomas Holgate, has the reputation of being a painstaking worker, with a large appetite for technical facts; and his long address bore this out. It occupied a full hour in the delivery; and if it was not punctuated by overt manifestations of enjoyment, it was listened to respectfully, and acclaimed at the end as a composition calculated to prove useful to members of the profession in divers respects. This is, indeed, the proper way to characterize it—it is a sound piece of workmanship, not brilliant, but eminently serviceable. It carried a good deal of point, and was not destitute of controversial suggestion. It was pitched, moreover, in a distinctly philosophic key, which was well maintained throughout.

The President began, as in duty bound, by saying something about the comparison of electricity and gas. He then proceeded to consider the principles of efficiency in gas manufacture, with which he had no fault to find, believing that the common routine does not cover any grave errors. This is as much as to say that he had no revolutionary ideas on the subject to ventilate; but yet he laid stress, very properly, upon the economical weakness of the routine of gas manufacture which is referable to the uncontrollable output of coke. He discussed several possible remedies of this embarrassment of the gas maker, premising that they are subject to qualifications of locality. For instance, he thinks that gas undertakings in the colliery regions might turn their attention more to the coke-oven system of manufacture, which would possibly help themselves and others. It is to be feared that the last consideration is not one that commercial undertakings can recognize as having any weight for them. Yet it really is remarkable that, after so much has been advanced upon this head of coke-oven gas production, not a single example exists of its adoption in the United Kingdom. It is to be expected that the ill-fortune which has overtaken the only instance of the same kind of thing in the world—the Boston concern, that has been so much vaunted for reasons that were made to look well on paper—will not encourage other capital to embark on a similar enterprise.

Mr. Holgate's alternative plan is a combination water and coal gas plant, made up of elements picked out from actual works examples. There is, of course, no novelty in this suggestion; and it cannot be said that Mr. Holgate succeeded in vitalizing the familiar scheme. He did, however, contribute something of his own to the details of such a combination; proposing that the coke, as drawn from the gas-retorts, should be carried out to producers, there to be subjected to a "blow" of steam, which would at the same time quench it. How producers could be kept going when one of their products would be cold coke, does not appear very convincingly. Mr. Holgate was able to testify from experiment, however, that coke which has been partially gasified is notably cleansed from impurities by the process, parting in this way with much of its sulphur. It would certainly be an advantage in many gas-works if the coke could be quenched thus inoffensively. Mr. Holgate is also an admirer of the outside producer plan of heating settings of retorts. One of the most useful observations of the whole address was the remark about the desirability of taking off separately, as quickly as possible, the first portion of the tar condensation, as this contains the pitch, which is nowadays almost the only product that tar is bought for.

After a cursory mention of Professor Lewes's well-known suggestion, the President set himself the task of sketching out a new gas-works carbonizing combination, which strikes one as a clever piece of patch-work, very creditable to the author's powers of observation and assimilation. It would be very impolite to lay too much stress upon the question of realizability. Afterwards, the address suddenly left the gas-works altogether, and took account of the gas-burners in consumers' hands; only to hark back again immediately to the works subjects of the naphthalene content of gas and the quality of fire-clay goods. This is useful matter. Next, Mr. Holgate turned to the subject of incandescent burners; and established a "record" by showing how an illuminative duty of 86 candles per cubic foot is attainable, and 100 candles per cubic foot well within the reach of the possible. This is indeed news. What the electricians will say to it is alarming to contemplate. Mr. Holgate, however, is no more instructed than anybody else as to the manner in which the Welsbach mantle does its work. We desire to draw special attention to the interesting information concerning the manufacture of low-grade coal gas supplied for Mr. Holgate's use by Mr. Woodward, of Salford. There is a good deal in these contributions of Mr. Woodward, which, so far as we know, are special. They are only paralleled by some data published at this meeting by Mr. H. E. Jones, which, however, are not quite on all-fours with the work of Mr. Woodward.

The address was followed by the reading of the posthumous paper of the late Mr. Bryan Donkin, on the heat efficiencies of prime movers, which did not lend itself to discussion. In the afternoon, Mr. H. E. Jones read his important paper on the "Illuminating Power of the Gas of the Future," which would have brought out a far more instructive discussion with a little better management. As it was, much precious time was wasted by speakers who had nothing particular to say, and said it at inordinate length. Still, the opportunity

for placing upon record the *cons* as well as the *pros* for light gas were not wholly lost, thanks to Mr. William King and Mr. Glasgow. To characterize the paper itself as an able production, is merely to say that it did not fall short of what might be expected of the author, who has just emerged triumphantly from a stiff parliamentary fight for freedom in gas manufacture for the Commercial Gas Company; but it is not by any means the last word that is to be said on all the questions it raises.

We cannot here fairly qualify all the papers. That of the ex-President, Mr. Herring, was instrumental in setting in motion the Council of the Institution in regard to the prescription of the form in which carbonizing accounts, for engineering purposes, should be framed. Mr. Browne's paper on "Condensation" was a valuable contribution to the limited literature of a highly important department of the work of gas making. It should really have been taken in conjunction with the paper by Mr. J. F. Smith, on the "Solubility of Naphthalene," inasmuch as the discussions on the two communications necessarily ran on identical lines. Mr. Livesey's interesting talk on gasholders was one of the freshest and most enjoyable features of the meeting. The marvellous memory for figures and facts, and grasp of argument, displayed by the speaker, were as striking as ever in the estimation of his keenly appreciative auditory; leaving one more impression, in addition to the many others similarly created, of the extraordinary mastery of gas engineering practice residing in the personality of the acknowledged head of the profession.

Friday's excursion was to Cambridge, to see the inclined retort settings at the University and Town Gas Company's works, and to visit so much of the collegiate city as could be crowded into a short afternoon. The fair antiquities of Cambridge were seen at their best, in typical April weather; and the numerous party had every reason to be pleased with the trip.

THE PROCEEDINGS SUMMARIZED.

[*The usual full report commences on p.* 1171.]

It seemed almost incredible that twelve months had flitted away since the same scene was being enacted as was witnessed in the vestibule of the Institution of Civil Engineers last Wednesday morning—there were the same men, the same hearty greetings, and all again on business of a like nature. Yet it really was so. For some of them, the twelve months which have flown have brought personal changes; and in the industry which they are all united in serving, there have been transitions of supreme importance. A reunion of this kind in the same surroundings produces reflection. But why look backward? The changes that have taken place in the industry are for its good. Therefore, it is the situation of to-day and the work of the future that demand the attention of all who have the welfare of the industry at heart.

Among those who met early was noticed Mr. Frederic Egner, and his presence at this time, we believe, imports changes in gas coal carbonizing methods in America. Mr. Egner is an honoured member of the American gas profession; and he has been on a visit to this country for the purpose principally of studying our installations of the inclined retort system, of which he is a staunch advocate. He tells us that there is every sign it will be largely adopted in his country during the next few years.

Ascending to the Lecture Theatre shortly after 10.30, the members at once settled down to business; and, scanning the proceedings which followed, it will be seen that the feature which stands out most markedly in them is the great consideration that was given to what is to be, or what is likely to be, rather than what has been. There was the question of amalgamation—hoped for as a thing of the future. There was the President's Address, a great part of which dealt also with the direction in which things are trending in the gas world. There was the paper by Mr. Bryan Donkin, showing plainly enough to the gas engineer what manner of gas is going to be largely used for power purposes now and hereafter. There was Mr. H. E. Jones talking of the illuminating power of the gas of the future. There was Mr. W. R. Herring appealing for the unification of the methods of stating the items comprising the carbonizing costs in gas-works, so as to aid the judgment of gas engineers in the future. And there were Mr. A. F. Browne and Mr. J. F. Smith advancing suggestions which may, and it is hoped will, be of great service. The only part of the proceedings which referred to the past was Mr. Livesey's reminiscences connected with the development of the gasholder.

But the object here is rather to give a bird's-eye view of the proceedings than to comment on them. The members having assembled, a smart tap on the table brought them to order; and Mr. W. R. Herring, the retiring President, was found in the chair, having for company the incoming President (Mr. Thomas Holgate, of Halifax) and the Hon. Secretary (Mr. J. W. Helps, of Croydon). The adoption of the Scrutineer's report, which added several new names to the register of the Institution, cleared the way for the discussion of

The Amalgamation Question;

and it is sincerely to be hoped that this really marks the beginning of the end. A *modus vivendi*, by which that which is desired may, if good counsels prevail, come to pass, has been pointed out; and, on this occasion, nothing was said which can cause any rankling on the other side—in fact, the discussion bore more on details than on anything else. It was plainly evident that the members are well tired of see-sawing over the question, and devoutly desire the consummation of their hopes. While all were intent on what was said, there was hardly a spark of animation in the several brief speeches that were made; and it was manifestly a relief when the talking was over.

This was the first appearance of Mr. J. W. Helps in the rôle of Hon. Secretary; and it fell upon him to introduce the subject of amalgamation. In calling upon him, the President, in a few appropriate words, referred to the appointment of Mr. Helps, whose services in a similar capacity elsewhere, he said, warranted the Council in feeling that he would contribute further to the usefulness of the Institution as their Hon. Secretary. On rising to refresh the memories of the members and to enlighten them on what has transpired in connection with the question, Mr. Helps had a reception which seemed to bear about it a ring of both sympathy and encouragement. In what he had to say, there was nothing "cut and dried." He had simply a suggestion to make for the members' consideration. Leading up to this suggestion, he reminded them of what happened at last year's meeting of the Institution and the Institute, and then gave the information that after last year's meeting of the latter body a conference was held by the Councils, and another on Feb. 15 this year. At these conferences, the only question that was worth any discussion was that of the inclusion of traders; for that is the knotted point. To cut a long story short, the suggestion that emanated from the conference was that a list of all who would be ineligible under the scheme for the new Association should be prepared and sent round to the members of both the Institute and the Institution, and those who received the greater number of votes should be retained on the list of the new Association. Beyond this, those members who had been gas engineers, and had left their posts, and secretaries acting solely as secretaries of gas undertakings, should be retained without any ballot whatever. This, briefly told, was the suggestion that Mr. Helps introduced to the members; and, in his concluding observations, he expressed the hope, which was the sentiment among the greater number present, that "something would be done to put an end to the present most unsatisfactory state of affairs."

This opening paved the way to discussion, which Mr. H. E. Jones, the new Vice-President of the Institution, initiated; and he supplied the pivot on which turned what followed. He led off by mentioning that he had had an informal discussion over this matter with Mr. Corbet Woodall and Mr. Charles Hunt; and therefore it may be taken that his proposal had their previous endorsement. He appealed to the members not to allow any narrow spirit of jealousy or anything else to intrude upon what is so essential—that is, a good strong Association for the gas industry. In considering the question, he classified the ranks of the industry into three—there were those whose stock-in-trade was their brains; there were those whose stock-in-trade was their goods; and there were those whose stock-in-trade was both brains and goods. His argument showed him favourable to the admission of those who fall in the last category; and he instanced the Institution of Civil Engineers, who admit to their ranks men who, connected with trade, have distinguished themselves in scientific work. He objected to the members taking upon themselves the odious task of determining who are and who are not ineligible for admission to

the new Association; and, in order to overcome the difficulty, he proposed that a class of honorary members should be created, to consist of such members of the trading community as, in the opinion of two-thirds majority of the joint Councils of the Institute and the Institution, have rendered distinguished services to the profession of gas engineering, or have promoted the interests of the gas industry. This, he thought, would enable them to pay a great compliment to the trade; and he believed it would create a class which would be neither small nor limited. Moreover, it would be the legitimate ambition of the traders to render themselves eligible to obtain admission. "We," he emphatically declared, "are determined that we will not, *quâ* a scientific Association, have our proceedings invaded by men who are traders, and who cannot help our scientific proceedings by a single jot." A cordial endorsement of the views of Mr. Jones was given by Mr. James L. Chapman, who seconded his proposal. Mr. Hunt was favourable to the proposition; but he preferred, rather than bind the selection down to a two-thirds majority, to leave it open to the new Council in the ordinary way.

While supporting Mr. Jones, Mr. Livesey announced a preference for entrusting the selection or nomination of the honorary members to the Council, and leaving their election to the general body of members in the usual way. He characterized the idea of submitting a list of names to the members as absurd; and then followed some strictures which, when read by those who did not hear them, will cause them to pause and think. Having referred to the union of the gas industry as most essential, he remarked: "I am not sure whether the gas industry would not be better without either the Gas Institute or the Institution, for what little good the two bodies are doing." There was a little objection to this; but Mr. Livesey, far from retracting, went on, and insisted that the good the two bodies are doing is practically *nil*. But these remarks must be read in conjunction with his following observations, which showed that his ideal of a representative organization for the gas industry is one which can take in hand work outside the limited scope of the existing bodies—an Association which can, for example, undertake the work of watching over the industry in Parliament and elsewhere (after the manner of the Gas Companies' Protection Association), and look after such affairs as "the little Welsbach matter," which he himself has been the means of bringing to a successful issue.

After this speech came suggestions of various kinds, which did not in the end affect, in any way, the resolution as proposed by Mr. Jones. The speakers included Mr. Charles Wood, Mr. T. Banbury Ball, Mr. J. C. Belton, Mr. William Foulis, and Mr. W. E. Price. Mr. S. Meunier was anxious to know whether the question had been looked at from a legal standpoint, to ascertain whether the associates of the Institute could take any steps to spoil the whole matter; but the President gave him an assurance on that point. In the belief that the members were "heartily sick" of the subject of amalgamation, Mr. E. A. Harman moved an amendment that the matter remain in abeyance. But the simple fact that no one seconded the amendment rather belied Mr. Harman's view of the matter.

The upshot of the fragmentary discussion was that the members gave a unanimous vote in favour of the only contentious point which blocks the road to amalgamation being surmounted on the lines of Mr. Jones's proposition—that is to say, by the formation of a class of honorary members in the united Association, to consist of all members of the trading community who have, in the opinion of a two-thirds clear majority of the joint Councils of the Institute and Institution, rendered any distinguished service to the profession of gas engineering, or who have specially promoted the interests of the gas industry. About this there is, as the President remarked, something fair and just; and now we have to wait and learn whether the members of the Gas Institute will take advantage of what must be regarded as a substantial concession to them on the part of the Institution. It will be seen later on that there was a further reference to the matter the following day.

The Outgoing and Incoming President.

With a few graceful words concerning the technical work of his successor, Mr. Herring vacated the chair; and Mr. Holgate received a hearty welcoming ovation on entering upon his duties. But Mr. Herring was not permitted to depart without a well-deserved acknowledgment of his services to the Institution during the year. The moving of the resolution which marked the sense of the gratification of the members was entrusted to Mr. William King; and he did not forget to mention the splendid entertainment which the late President gave the members on their visit to Granton in September last. Both Mr. A. E. Broadberry (in seconding) and the President appropriately added to the eulogy uttered by the mover of the resolution; and the members emphasized all that was said in the most liberal manner. Mr. Herring's response was couched in well-chosen words.

The President's Address.

The way was then clear for the delivery of the Inaugural Address. The matter of which it is composed is dealt with in the "Review of the Proceedings;" and therefore it does not demand attention here. It may, however, be said that alone it is a full justification of the choice of the members in electing Mr. Holgate to preside over them. Among presidential deliverances, it will stand out for its freshness in matter and treatment. There is a cursory backward glance in the fore part of the address; but the greater part of it is devoted to the work of the future, and upon that came some of the fruit of the President's own research. It must have been highly gratifying to him to hear Mr. H. E. Jones say, in moving a vote of thanks, that he had never listened to an address which showed such careful preparation, was more suggestive, or more thoroughly practical and scientific. That was also the view of Mr. J. L. Chapman, who seconded; and the verdict of mover and seconder was accepted with accord by the members.

Steam, Gas, and Oil Engines; Cost of Fuel and their Heat Efficiencies.

The members then settled down to the consideration of the papers. The first brought before them was on the above subject. "Unrevised" appeared in the top left-hand corner of the copies distributed; and it is sad to contemplate that unrevised by the author it will remain. It was prepared for the meeting by Mr. Bryan Donkin, just previous to his much-lamented death. Under such circumstances, the members and the gas profession generally will always look upon this contribution with especial veneration. Before the paper was read, the President made some remarks which will place on record the appreciation of the gas profession of the work of Mr. Donkin and the sincerity of their regret that he is no longer in their midst to pursue the work with which his name is associated.

The paper is a short one; but its value cannot be measured by its length. Our late friend possessed the gift, even if he did not always exercise it, of being able to compress the most brilliant points of a subject into narrow bounds, so as to bring them into view at once, and thus save the reader or the listener the trouble of wandering about in search of them. His first words in the paper were: "It is very desirable to fix upon some correct standard of comparison, from a heat point of view, for oil, gas, and steam engines in daily use;" and, without much intermediary matter, we come to his view that the thermal efficiency per brake horse power is probably the most accurate standard to adopt. Such efficiency is the ratio or percentage of heat actually used in a test to that theoretically required per brake horse power per hour, whether for steam, gas, or oil. But he points out the necessity, in order to make a real commercial comparison, for stating the price paid in a given town for the very different fuels used—whether coal, oil, or gas. When this is known, the cost per unit of power can readily be calculated. The question which the author set himself is this: In a given town, taking certain practical thermal efficiencies (based on tests) for gas, oil, or steam engines, and for the generator or boiler certain prices of fuels, what is the cost of the fuel only per brake horse power per hour? The great variation in the cost delivered of different fuels in different localities is a point of importance; and the author has in the test work from which he has drawn his figures taken London as the locality and in some cases the Midlands. As the thermal efficiencies of the engines also vary much per brake horse power, according to the type, size, make, and other circumstances, he takes a high, an ordinary, and a low efficiency to suit various cases. The paper is accompanied by six tables, which give the results of his tests, and a mass of useful figures. In the text of the paper, however, are incorporated the salient features of the tables so far as they bear upon the points to which he immediately directs attention. In the case of steam-engines, he takes

18 per cent. thermal efficiency for the high-class one, 8 per cent. for the low-class one, and 13 per cent. for an ordinary average example. Turning to the tables, it is found that the cost of fuel per brake horse power per hour for the first class is given as 0·225d.; for the low class, 0·326d. and 0·151d.; and for the ordinary, 0·196d. Coming to producer gas, the efficiencies given per brake horse power for the gas-engines (from tests) range from a maximum of 24 per cent. to a minimum of 14 per cent. Here the cost of fuel per brake horse power per hour works out in different cases from 0·137d. to 0·250d. With lighting gas, the best efficiency of the engines varies from about 25 to 14 per cent. per brake horse power—18 per cent. being usual. With London gas at 2s. 3d. and 3s. per 1000 cubic feet, the cost of the gas per brake horse power comes out rather high—from 0·458d. to 0·847d. (These figures refer to gas-engines of only from 1 to 20 horse power, as against much larger engines in the other cases.) For oil-engines, the thermal efficiencies per brake horse power (based on tests) range from 27 to 14 per cent.; and the cost of the oil per brake horse power per hour from 0·372d. to 0·717d. To make a comparison with Mond gas, the author supposes rather a small Mond producer at work in London. The heat efficiency for the gas-engine in this case per brake horse power ranges from 26 to 22 per cent.; and the cost of coal per brake horse power per hour for London comes out very low—from 0·087d. to 0·103d., and an example from the Midlands at 0·047d. The figures in this brief summary are interesting for purposes of comparison; but to get the whole of the facts and to fully realize their importance, it will be necessary to study the tables.

There was no discussion on the paper, which was read by the Hon. Secretary.

The Illuminating Power of the Gas of the Future.

The whole of the afternoon sitting was occupied by the reading and discussion of a paper by Mr. H. E. Jones, in which he considered the above question. His leading inquiry is, What is the gas of the future to be? And his answer is: Clearly a calorific gas—and the cheapest, in the true sense of what will be the most generally useful to the consumers, having regard to the cost of its production and distribution. The paper is of considerable length, and as its contents cannot be fairly epitomized from beginning to end with the brevity demanded here, it is better to get as quickly as possible to the part of the paper which brings under view the conclusion to which Mr. Jones has arrived from his study of the question. The introductory matter shows the necessity of a cheaper fuel in a gaseous form, and the wastefulness of incurring cost in enrichment when present conditions of illumination are considered. The author feels himself safe in saying that the "gas of the future" will be neither producer nor water gas. Then a little further on, we find the direction in which his investigations have led him. He has been considering how far coal gas (which has admittedly the highest calorific value, and is the easiest distributed) can be stretched in the sense of increasing the volume at the expense of the illuminating power without causing such serious detriment to its calorific value as would be material—having in view the production from a ton of coal of the largest quantity of low-grade illuminating gas, supplemented by such a quantity of water gas as could be provided from the surplus coke available from the coal gas production, such water gas to be enriched as far as possible by the use of all the volatile constituents of the tar, or if necessary with such a moderate amount of oil gas as shall bring it up to a useful calorific standard. Data bearing upon these questions form a very useful part of the paper; and then we come to what is the essence of the whole matter. The author finds that, applying the figures of an ordinary year's working, the cost into the holder of unenriched coal gas would be, for 10,000 cubic feet of 15·3-candle gas, 12d. per 1000 cubic feet. If the quantity be increased to 11,500 cubic feet of 13·31-candle gas, the cost is reduced to 10·43d. per 1000 cubic feet, having a heating power of 544 British thermal units per cubic foot. Plain water gas, equivalent to 304 British thermal units per cubic foot, will cost per 1000 cubic feet, with coke at 8s. 4d. a ton, and including purifying, wages, and wear and tear, 5·75d. The addition of carburetted hydrogen, in the shape of gas oil to the extent of 1¼ gallons, would cost, at 2¾d. per gallon, 3·43d. This brings up the cost of the mixture to 9·18d., and would add 162·5 cubic feet of gas, having a calorific value of 225,000 British thermal units. Adding 837·5 cubic feet of plain water gas, with a heating value of 304 British thermal units per cubic foot, gives 254,600 British thermal units, so that 1000 cubic feet of gas is obtained with a heating value of 479 British thermal units per cubic foot. If, therefore, there is added as much of this gas as will exhaust 1000 lbs. of the coke from the manufacture of 11,500 cubic feet of coal gas, the following mixture is realized:—

11,500 c.f. of unenriched coal gas at 10·43d. .	120d.	to 543·3 B.T.U.
20,000 c.f. of carburetted water gas at 9·18d. .	183·6d.	to 579 ,,
31,500 c.f. costing	303·6d.	

Or an average price of 9·6d. per 1000 cubic feet for gas having an average heating equivalent of 502 British thermal units. For interest, distribution, rates, management, &c., the author allows 7·35d.—making a total cost for the gas of 16·95, or 17d. Therefore, against 16-candle gas, having a calorific value of 640 British thermal units at (say) 2s. 8d. per 1000 cubic feet, a gas could be supplied of 502 British thermal units at 1s. 5d. per 1000 cubic feet. Further possible economies are pointed out by the author. He does not suggest, nor does it seem necessary, that changes should be effected by any sudden wide departure; but he does not regard it as a difficult step to go to an illuminating power of 12 candles with a corresponding reduction in price to the consumer at an early date, and the further step to 10 candles would be a matter for subsequent consideration. Several other points, such as purification, distribution, and charges are dealt with by the author. The subject of the communication, and Mr. Jones's manner of treatment, undoubtedly place it at the head of contributions to the proceedings.

The discussion, taken as a whole, was rather discursive; and the members showed a greater willingness to deal with details, and confirm the introductory questions raised, than confine themselves to the suggestive matter which formed the cardinal feature of the paper. Mr. C. E. Botley opened with some interesting remarks. In obtaining relief from restrictions as to illuminating power, he sees an extensive field for the larger utilization of gas-works. He, however, deplores the want of small gas motors to compete with electric motors; and in this connection, he has been experimenting to ascertain what can be done in the way of producing electrical power by using poor-grade carburetted water gas in a gas-engine. With 5 or 6 candle gas, he has been able to get nearly the same power as with ordinary gas. Some remarks by Mr. J. S. Ashworth confirm the existing necessity for a lower grade and cheaper gas than at present. In the view of Mr. F. W. Cross, the author's figures are not wholly conclusive; and he challenged several of them. He is in agreement with those who talk of 14-candle gas; but he scouts the idea of a 10, 8, or 6 candle gas. The percentage use of incandescent burners, in his view, will be comparatively small as compared with flat-flame burners. His own figures for carburetted water gas last year do not show that the cost of enrichment by its means is great. He gives the cost of his coal gas at 22·54d., and of carburetted water gas at 18·88d. Figures as to the consumption at Wellingborough during different hours of the day, and at different seasons of the year, were given by Mr. J. T. Lewis. A remark or two by Mr. Harman bore upon a point not dealt with in this summary; and the same must be said of much of the comment by Mr. T. Goulden. But this gentleman complains of the little available information as to the calorific power of low-grade gas. He is of opinion that, in giving the public low-power gas, the calorific ratio must increase as the illuminating power is dropped, or the deductions hitherto made from present prices must be much greater. Mr. A. G. Glasgow was next invited to speak; and in view of the position he had taken in connection with this question, his response to the call put the members in a state of interested expectancy. His argument followed the lines he has already adopted in our columns. No sufficient indication of the argument can be given without reproducing the speech in full; and readers who are interested must refer to the ordinary report of the discussion. Its intention was to show that, taking Mr. Jones's figures, as the mixture of gases involves a diminution of heat delivered to the consumer, there must be some compensating reduction in price made to the consumer; and Mr. Glasgow cannot see where the saving equal to that compensation is going to be effected. In making comparisons of the cost of carburetted water gas and coal gas, he says it should be borne in mind that the cost of the former depends upon the extent of its candle power. Mr. William King is of opinion that

it is impossible to lay down a hard-and-fast rule as to what the illuminating power of the gas of the future for any town is to be. The conditions of a town—as to whether it is residential or manufacturing—must be taken into consideration. Speaking as the representative of a Company supplying one of the highest, perhaps the highest, illuminating power gas in England, he cannot shut his eyes to the fact that a large proportion of the consumers still use flat-flame burners; and he believes it will be a long business to introduce incandescent burners among the slot consumers. In these days of cheap oil for enrichment, he thinks that gas engineers should hesitate before a great reduction is made in illuminating power. Mr. Jones's reply to this was a quotation of figures showing the great and rapid changes that had taken place in the price of oil. He agrees with Mr. King that a general rule as to illuminating power cannot be laid down; but he regards the cheap incandescent burner and mantle as the "leveller." Nothing has, he says, happened during the last thirty or forty years of such importance as had taken place recently in connection with the lowering of the price of incandescent burners and mantles. He admits that his calculations have been somewhat roughly made; but his answer shows that nothing was advanced in the discussion which shakes him in his belief that they are approximately accurate.

Unification of the Methods of Stating Carbonizing Costs.

The first paper read on Wednesday morning was by Mr. W. R. Herring; and in it we have a personal interest, inasmuch as it had its origin in a suggestion made in these columns last December, as to the advisability of a step being taken "to frame a definite list of items which would comprehend the various costs of the inclined retort system." The difficulty of obtaining in discussions on the inclined systems, and at inspections of installations, really comparative figures as between works and works, owing to the want of a uniform basis of comparison, gave birth to the idea. Mr. Herring went beyond our suggestion, and very rightly; and he made out a good case for an all-round change in the methods of stating carbonizing costs. As he points out, the extensive adoption of mechanical appliances in the manufacture of gas has rendered former methods of stating costs almost, if not quite, obsolete; and, for excellent reasons, he discards the old basis of stating the capital per ton of coal carbonized as a criterion of the efficiency of a gas-works administration. Mr. Herring does not overlook the fact that every £100 of capital expenditure involves an additional burden; but, seeing that the abolition of the labour of one man at £60 per annum will pay interest at 6 per cent. per annum on a capital expenditure of £1000, he does not see much fear of the capital involved in the introduction of labour-saving appliances exceeding the profitable limit. In his view, the gas-works of the future must be judged on the basis of the initial manufacturing costs for labour throughout the works per ton of coal carbonized, which item may be subdivided to the greatest possible extent; and in order to overcome any inequalities as regards rates of wages and hours worked in various towns, the unit of tons per man per hour should be adopted. The opportunity was too good for Mr. Herring to pass without throwing down the gauntlet to those who deny the superiority of the inclined retort system over other methods of carbonization, and hard by we find him referring to horizontal stoking machinery as the "next best method." But to judge between the various systems, and between plant and plant, he does not think it an impossible task to bring about a uniformity in the methods of stating figures. Examining the lines that the suggested inquiry should take, the author points out that, in the first place, variations in the rates of wages are a disturbing element; and therefore the figure should be stated in the weight of coal handled per man or hundred men. The duration of hours worked per man should also be stated; and the inquiry should cover every item in the cost of manipulating a ton of coal from its receipt in railway waggons or otherwise to the discharge of the coke into the yard, carts, or waggons. The capital expenditure, too, involved in constructional works must not be lost sight of; but—and this is a point of importance—it is the earning capacity of the capital that should be most carefully ascertained, and not the initial outlay on any particular plant. Of course, in regard to capital expenditure on different works, the costs of structural material in different localities, and individual ideas of structural stability, are difficulties and have their influence. Under varying circumstances of this kind, the quantities sheets must be of supreme importance; and by their aid adjustments may be made. The compilation and comparison of the working costs in the minutest detail alone will, says Mr. Herring, "enable us to determine exactly the value, not only of the plant as a whole, but of the subdivided parts of the plant, and will clearly show how far it is commercially profitable to spend money on various devices." The author's concluding words, which refer to the suggestion being brought forward as "an urgent necessity of our time," and as to the object being an "all-important" one to the gas profession, are to us a very gratifying recognition.

Mr. Herring supplemented his paper with a resolution to the effect that a small Committee should be appointed, with instructions to determine the basis on which the items comprised under the head of carbonizing costs should be classified, and to publish the result of their deliberations as soon as possible. Many good reasons for adopting the resolution were also advanced by Mr. F. W. Cross; but he is not altogether sure that the ton unit should be adopted. Mr. Charles Hunt also recognized the advantage of the proposal, but he moved, as an amendment, that the matter be referred to the Council to consider, and, if thought desirable, that they appoint a Committee—not necessarily of their own number—to carry out the object of the proposal. Mr. Herring saw no objection to the adoption of the amendment so long as it accomplished the object in view. The President thereupon put the amendment; and it was unanimously carried. This gave rather an abrupt termination to the matter, which was a pity, as it was evident that there were several members who were prepared to challenge some of the statements in the paper which had manifestly been purposely inserted to raise debate. For example, Mr. H. E. Jones subsequently expressed the hope that the inquiry would not be limited to the ton-of-coal basis, and that the reference would be an unlimited one. Mr. R. O. Paterson, too, made it clear that his acquiescence in the resolution does not commit him to an acceptance of all that was stated in the paper; and he instanced the author's assertion as to the superiority of inclined retorts. Mr. A. Wilson, of Dawsholm, who has taken a fighting part in the controversy in our columns recently, had found points in the paper to discuss; but the hasty passing to the next business prevented him. Although the opportunity for further discussion at the meeting was lost, the columns of the "Journal" are open; and we have not the slightest doubt Mr. Herring will heartily welcome criticism favourable or otherwise. But any comments on the paper and its main purpose should be made at once, before the Council take the question into consideration.

We have already received one communication on the subject. It is from Mr. Alexander Wilson, of the Dawsholm (Glasgow) Gas-Works; and we shall publish it, in our next issue, with the report of the short discussion on the paper. In the meantime, it may be mentioned that Mr. Wilson has no doubt that with the main object of the paper, and with the resolution passed, most of the members are in accord. He agrees that, whatever system of tabulating costs is to be adopted, the one which enables gas engineers best—with a reasonable amount of trouble—to put their finger on weak or costly items of their work, must receive favourable reception. When the communication is published, it will be seen that our correspondent has a little thrust at Mr. Herring on account of his eulogy on inclined retorts. There is no doubt that he regards the author's remarks in this respect as dogmatic; and he regrets that the paper contains no attempt at substantiation of the assertions made. The letter is an interesting one.

Amalgamation Again.

The Hon. Secretary here interpolated a further statement on the subject of amalgamation. It seems that he had been reviewing the position in which it was left the previous day; and it was not entirely satisfactory. He now introduced it once more in order that what was done on this occasion might be final. The whole point was as to the position of the secretaries of gas undertakings on the Institute list; and after some remarks by Mr. Jones, Mr. Chapman, Mr. Meiklejohn, and Mr. Harman (who declared that the matter being raised again without notice was irregular), a motion was passed agreeing to their admission to the new Association as associate members. It may be mentioned that Mr. Jones stated that he should also like to see the chemical side

of the gas industry allied to the new Association, and was even favourable to the admission of secretaries and auditors as associate members.

Coal Gas Condensation—A Theory.

The paper which Mr. A. F. Browne contributed, on the above subject, was most valuable; and it may be taken as supplementary to Mr. Charles Carpenter's recently discussed Southern Association paper—indeed, the facts and conclusions upon which the present communication is founded are the outcome of the same inquiry. An important part of the communication is tabular matter, which defies the abstracter. The first table is an estimate of the duty required in condensing from 140° Fahr. to 60° Fahr. a volume of crude gas, which, when cooled and purified, measures 2 million cubic feet. The table shows that 87 per cent. of the total work of condensing this volume is expended upon aqueous vapour, and 13 per cent. upon the permanent gases and other vapours. Therefore, if aqueous vapour were absent, the cooling of the gas would, in Mr. Browne's own words, "be a bagatelle." But the vapour of water is not the only vapour which coal gas carries. More often than not it is saturated as it leaves the retort with naphthalene vapour. Hence it follows that the theory of condensation must be based upon the physics of the contained vapour. The author asks the question, Upon which side of the exhauster should gas be condensed? and he enters into a thorough examination, in order to find the answer. He thinks that it must be admitted that the work of the condenser on the pressure side is increased by the additional heat—be it much or little—mechanically put into the gas by the exhauster, with the result that the condensation is correspondingly retarded. Nevertheless, from a theoretical standpoint, the disadvantage attaching to condensation under pressure is, after all, of small importance. In fact, it must be negligible in works where exhaust and pressure are within normal limits; for at the Vauxhall Gas-Works, where both are unusually high, a change to the pressure side would only increase the load by 4 per cent. The theoretical position of the condenser would appear to be that where it possesses the greatest self-cleansing facilities, together with the maximum advantage derivable from the highest head of difference between the temperature of the gas and that of the cooling agents—the latter being the true factor of efficiency in condensers. Such a position is necessarily found in closest proximity to the retorts. The author has something to say on the reversible condenser; and a number of figures of special interest are given. In pointing out the indications of these figures, the author says "what is needed is to bring about 'accelerated,' as contrasted with 'retarded' condensation—in short, if the paradox may pass, to cool the gas while hot." Mr. Browne asks another question, Can the naphthalene nuisance be brought within negligible limits by the ordinary process of condensation? He says the fact is still in doubt; but the outlook is hopeful. What seems to be required is greater control (1) of the apparatus, that it may realize its maximum attainable efficiency between the limits of the temperatures supplied to it, and (2) of the cooling agents, to effect, if possible, an extension of those limits of temperature. The author is induced to think that, should natural temperatures be found inadequate, artificial temperatures could be resorted to. It would be necessary to cool but a small quantity of water—perhaps, 10 per cent.—from (say) 68° to 52° in summer, and from 40° to 30° in winter. He has reason to believe that plant to cool this quantity by the ammonia process, including a gas-engine, could be laid down for £225 per million for 2½ millions per day, £140 per million for 5 millions, and £100 per million for 10 millions.

The discussion on the paper was undoubtedly the best of the whole meeting. Among the speakers was Mr. Charles Hunt, who says it should be the aim of the gas engineer to avoid the deposition of naphthalene in condensers, and get it taken away automatically by the solvent constituents of the tar. He was rather curious to know what had led Mr. Browne to the conclusion that rapid cooling of the gas was desirable; and then he related experience he had had with deep-well water, which he finds very constant in temperature. With such water, at a temperature of 54° to 57°, he is unable to keep the gas down to the temperature to which it is subjected in the distributing-mains in the summer time. But he has been reluctant to introduce any artificially cooled water, as it seems to introduce a complication, which is undesirable if the effect can be produced in some other way. He also believes that slow condensation rather than rapid is the real solution of the question. From inquiries that he has made on the subject, Mr. Harman is convinced that the figures given by Mr. Browne for the ammonia refrigeration process are under the mark. The experience of Mr. W. E. Price leads him to pronounce in favour of slow condensation and longer contact with the light tars; and Mr. J. S. Reeves holds similar views. Mr. R. O. Paterson was also opposed to the author. It seems to him that what Mr. Browne wants to take out of the gas in the most rapid manner is that which should be retained in it as far as possible. Long contact with the tarry vapours, in his opinion, is the best way to remove naphthalene. A high compliment was paid the author by Mr. Charles Carpenter, when he said that, before Mr. Browne took this matter in hand, there was absolutely no information on the question. Mr. Carpenter looks upon naphthalene as a troublesome hydrocarbon which the sooner it is got rid of the better. He advances a very important point when he states that, comparing the finished gas rapidly cooled with gas cooled at a slow speed at another works, with all other conditions of working similar, there is not the slightest difference in the illuminating power tests of the London County Council. He also thinks that some system of cooling water is desirable; but he considers ammonia processes rather costly. He suggests that a cooling arrangement could be made by passing water through pipes covered with canvas, over which water could trickle, and the whole be kept cool by a fan. Mr. C. F. Botley spoke on the efficiency of cooling air condensers by an automatic mist of water. Mr. Foulis finds slow condensation more beneficial than rapid. Mr. T. Glover's opinion is, it is now generally admitted, that naphthalene must be dissolved out of gas—whether through the introduction of oils extracted from tars, or whether the oils should be made by artificial temperature or pressures has not yet been resolved. What is wanted is not only time contact and low temperature, but surface contact as well. Numerous points which have not been introduced in this epitome were dealt with by Mr. Browne in his reply; and in large measure his remarks supplemented the information in the paper. He thinks it will be admitted that, if gas can be rapidly cooled in a comparatively small apparatus occupying a comparatively small space, without any final loss of illuminating power, it must be more desirable than having the miles of pipes seen in some large works. The prices given in the paper for plant for the refrigeration of water, he tells us, were prices actually quoted to him. Regarding time contact, it seems to him that the lower the temperature the less would be the quantity of light tars available for the dissolving of naphthalene. He thinks the reversibility is really the most useful feature existing in condensers to-day. The removal of naphthalene by solvents in separate vessels, he points out, requires expensive plant. Then there is the purchase of the solvents themselves; and it is conceivable that their disposal after the extraction of naphthalene might be a matter of some difficulty. If, therefore, the work can be done by the mere process of condensation, it appears to Mr. Browne to be the best way of achieving their object.

The Solubility of Naphthalene.

A useful little paper was next introduced by Mr. J. F. Smith, of Halifax. It describes certain tests which he has made on the subject of the solubility of naphthalene. But in the preface to the main part of his paper, the author declares his disbelief in the contention of some gas engineers that carburetted water gas is a preventive for naphthalene deposits; and he definitely asserts that it is possible to make as much naphthalene with a carburetted water gas plant, both where petroleum and the unsaturated oils are used, as it is in the manufacture of coal gas. The object of the author's experiments was to determine a point on which information is scarce—that is, the most suitable solvent to employ for naphthalene in order to prevent its deposition. He explains in detail the methods he adopted in the experiments, and so their worth may be judged. Of thirteen solvents which he took, it appeared that pure benzol is the best; This is true, supposing the solution can be removed from the gas-mains as soon as the naphthalene is completely dissolved. But when a solution passes into the mains, through which it has to travel before it can get to the drip-boxes, evaporation takes place; and, if the distance is great, the solvent is picked up by the gas, and carried forward to the burners, conveying, in the belief of many, some of the naphthalene with it. But the extent to which it is done is, in Mr. Smith's opinion, much over-estimated. This carried

him on to a second set of experiments, to find the extent to which naphthalene would be carried forward with some of the solvents under examination. The result pointed to the evaporation of the solution of naphthalene in the mains varying according to the concentration of the solution dealt with—the more concentrated the solution, the more naphthalene was carried with the solvents.

The discussion was commenced by Mr. A. E. Broadberry, who challenged the statement regarding carburetted water gas. He gave an account of his experiences at Tottenham, where they use 50 per cent. of carburetted water gas, which prove, to his satisfaction, that, when the plant is in operation, there is practical freedom from naphthalene deposits; and when it is not, the trouble reappears. Possibly the fact that such a large proportion of carburetted water gas is used may have something to do with the difficulty. It also appears from his remarks that at Tottenham, the condensers dealing with coal gas have been reversed during the past five years; and during that time there has been no need to clean them out, whereas previously the operation had to be performed every summer. As to the use of solvents, Mr. R. Beynon, of Torquay, is of opinion that the price must have influence as to the solvent employed. However, he is going to make an experiment in washing his gas with oil by utilizing one or two chambers of a washer. Unhappily, Mr. J. L. Chapman has found that since he introduced carburetted water gas, he has had naphthalene deposits. Before then he was never troubled. Working at too high heats in his opinion is the cause of the trouble. He has tried the effect of the use of green oil in his washers, but has been unsuccessful with it. Mr. T. Glover's experience in connection with water-gas plant is that, if the oil, or a proportion of the oil, is split up at low temperatures, there will be little trouble from naphthalene. But if the highest results are expected from the oils, then the naphthalene trouble will exist. He also supplied some information on the question of the use of solvents. Regarding the contradictory evidence as to the effect of the use of carburetted water gas on naphthalene, Mr. C. F. Botley attributes the differences in experience to the variations in the amount of oil used and the manner in which the gas is made. Mr. S. Glover spoke as to the successful application of oils for washing gas and other cognate points. A few comments by Mr. Smith ended the discussion.

This had brought the proceedings to the middle of the afternoon sitting on Thursday; and then Mr. Livesey gave the members a treat by drawing from his memory a number of historical facts relating to the

Development of the Gasholder.

This was quite an impromptu effort on Mr. Livesey's part; but the chatty style in which he presented his facts, and the introduction of several amusing incidents bearing upon early gasholder work, added to the interest and charm of this part of the proceedings. It is difficult to know what to call Mr. Livesey's contribution. He would object to it being described as a "dissertation" or even as a "lecture;" and the term "talk" employed in the *agenda* very inaptly characterizes it. The interesting contribution to the proceedings will be reported in full. But in the meantime it may be stated that the first gasholder Mr. Livesey saw was one built for the Gaslight and Coke Company, in the year 1838; and the first one he remembers seeing erected dates back to 1840. This one cost some £35 per 1000 cubic feet capacity, as against £5 for one of the last holders built. Very interesting were his recollections of the central column holders built in the thirties at the Old Kent Road; and he gave their dimensions and capacities. He passed on to the holders of the forties; and then came to telescopic holders. He does not know who originated these; but he describes him, whoever he was, as a "clever and ingenious fellow." The light gasholders constructed by Croll in 1850 (which 25 years later were characterized by Mr. Thomas Hawksley as "gossamer" holders), are, Mr. Livesey states, standing now; and they were untrussed. Then the work of Mr. William Innis, the Engineer of the Phœnix Gas Company, was brought into the review. One of his holders at the Kennington Lane station had thick boiler-plate columns bolted, with a simple flange, on to a cast-iron plate, covered over with a sham moulding. At the top Mr. Innis attached them by tie-rods. In the eighties, Mr. Livesey says, they felt rather uncomfortable about these columns, and girders were put to them. The fact that the columns, with such an unstable base, held for thirty years without any mishap, seems to indicate that but little is necessary to keep a gasholder in its place. All this time gasholders were gradually growing in capacity; and Mr. Livesey went on to give the names of the builders of holders in their order of size development. In 1860, Mr. Robert Jones was the constructor of the then largest holder; Mr. Thomas Kirkham made the next step; and coming to the seventies, he accorded the honour to Mr. Corbet Woodall, with his holder of 3,100,000 cubic feet at Kennington Lane, which was built without trussing. The 8 million gasholder at East Greenwich was the next development, and finally he reached the 12 million feet holder at the same works. This holder is built in a shallow tank; and the idea was that of the late Mr. Frank Livesey, on account of the difficulties of the site. This shallowness made it necessary to have a combined system of radial and tangential rollers top and bottom; and by this means the holder was made safe. For perfect security with shallow holders, he is not certain whether it would not be well to adopt Pease's wire-rope guides as well as the rollers. Mr. Livesey also brought to notice the notable advance made in telescopic holders by the late Mr. William Mann with a three-lift one at the works which at one time existed at Blackfriars Bridge. The improvements in curbs and cups were called to mind; and the curved bottomed cup first proposed by Piggott for one of the South Metropolitan holders in 1862, was referred to as one of the greatest improvements made in gasholders. Paddon's ties and the development in the framing received notice. Mr. Livesey believes it is safe for a gasholder to go one-third or at most two-fifths of its height above the framing; but he should not like one to go half its height above the framing. In this connection, he called to memory the work of Mr. Webber, of Messrs. Gadd and Mason, and of Mr. Pease. His one objection to the spiral and wire-rope systems of guiding is that the stress of wind coming upon the holder must be carried to the ground in some way; and he thinks stress or pressure should be carried independently of the holder. If there is no framing, it must be carried to the ground by the sheeting; and this imposes on the sheeting a strain it ought not to bear.

At Mr. Livesey's desire, discussion was invited, and contributions were made by Mr. Webber, Mr. Hunt, Mr. Foulis, Mr. King, and Mr. Herring. In speaking of the Gadd and Mason and the Pease system of guiding, Mr. Hunt stated that he thinks, as time goes on, evidence in favour of both these systems will increase; and he does not see any real limit to their application. Mr. Harman reminded Mr. Livesey of one omission from his list of notable names connected with gasholder work—that is, Mr. Cripps; and Mr. Livesey made a handsome acknowledgment of the indebtedness of the gas industry to that gentleman.

A Message of Sympathy and Votes of Thanks.

The President made a brief reference to the illness of Mr. W. R. Chester; and it was decided to send a message of sympathy to Mrs. Chester and the family in their severe affliction.

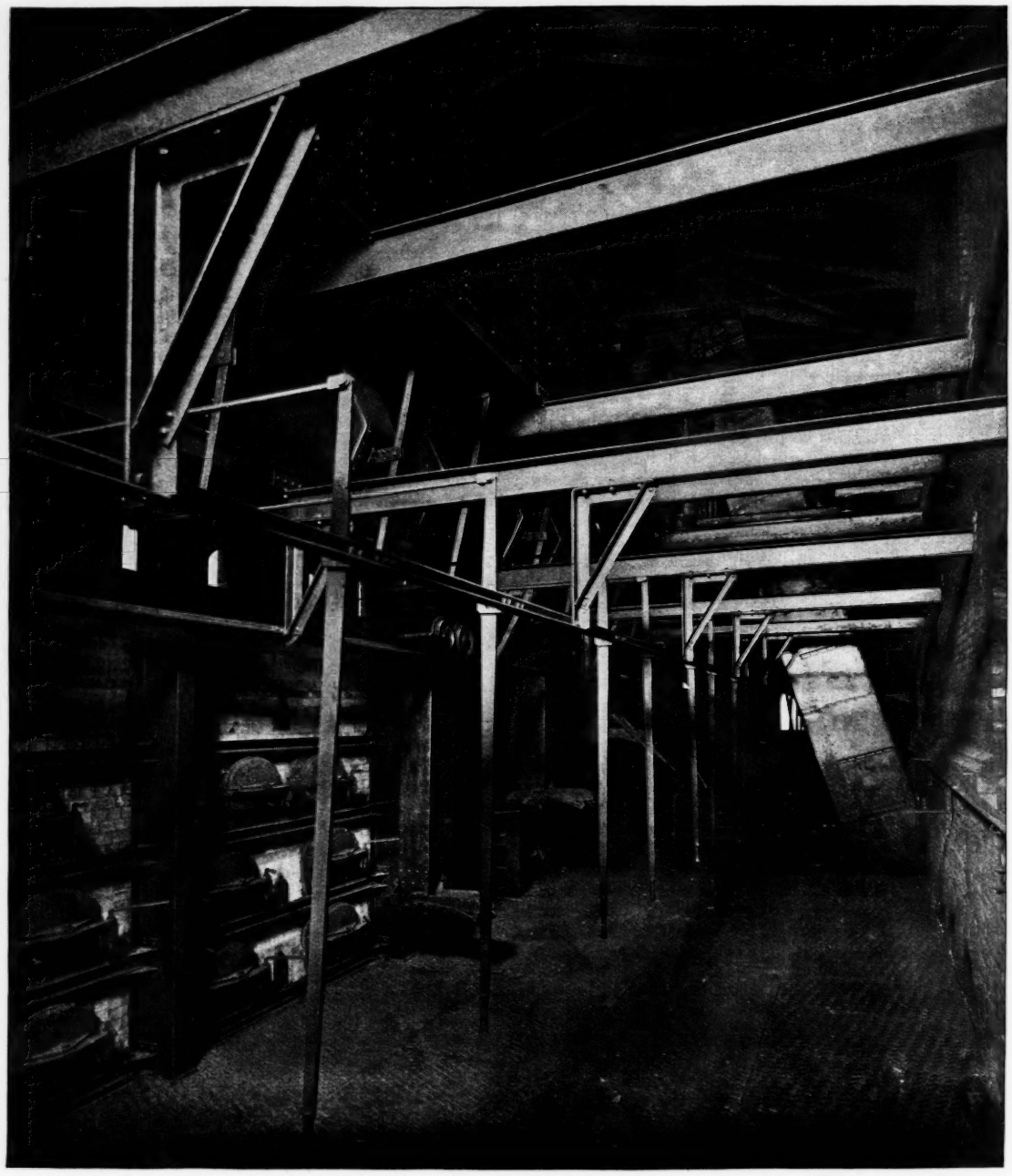
The sitting concluded with a shower of votes of thanks to all who had contributed to the success of the meeting, and to the office-bearers of the past year.

The Social Side.

The annual dinner was held on Wednesday evening at the Hotel Cecil; and on Friday there was an excursion to Cambridge, a more extended notice of which appears below.

EXCURSION TO CAMBRIDGE.

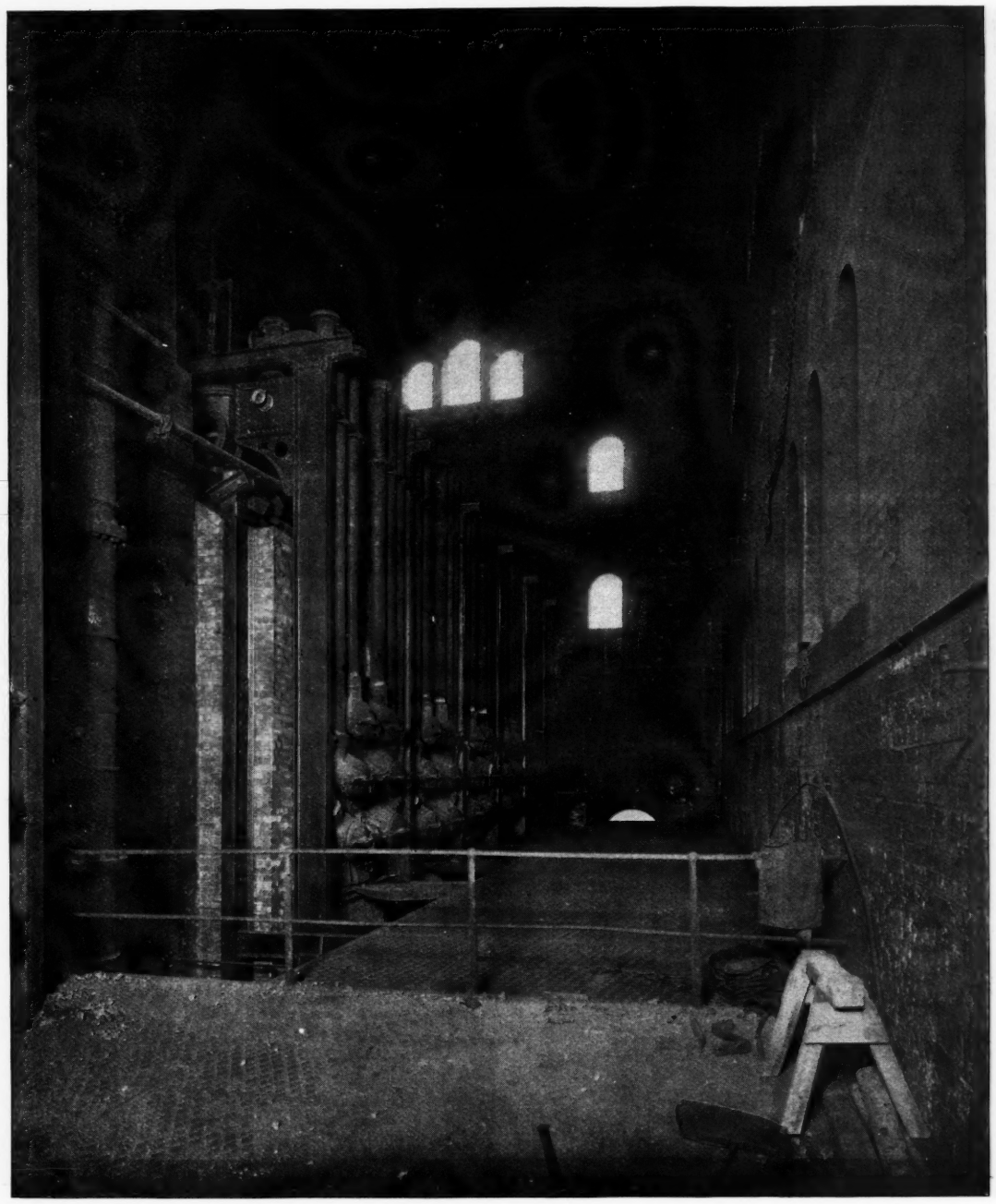
The outlook on Friday morning was dismal in the extreme; and when fifty or thereabouts of the members entered the saloon carriages attached to the 9.12 train from Liverpool Street, there was an almost general feeling that the rain and rawness which then prevailed were to be accompaniments of the day's outing. But the fates were not altogether against the travellers. By the time Cambridge was reached the weather looked a little more promising, and during the day there were only a few sharp showers, with intermediate brightness. Arriving at the collegiate city, the party found Mr. Richard Brown, the Engineer of the Gas Company, on the platform to receive them; and it was Mr. Brown—and he alone—who made the visit the success that it was. He gave himself up entirely throughout the day to the members, and, through his instrumentality, the best that Cambridge contains was seen by them.



CHARGING-FLOOR OF INCLINED RETORT-HOUSE AT CAMBRIDGE.

Following the events of the day in the order in which they occurred, the party were driven from the railway-station to the gas-works; and there Mr. Brown and his assistant (Mr. H. M. Bairstow) devoted themselves to pointing out the features of the place, and answering inquiries. The new work which has been carried out since Mr. Brown has been in charge of the concern has been referred to in the "JOURNAL" several times; and therefore an extended notice is not now necessary. The central attraction was, of course, the inclined retort-house; and this, with the exception of the new coke-conveyor (which is to be of the Little type, and will be placed in position during the next two months or so), is now practically completed. The house was formerly equipped on the horizontal system; and for the reception of the inclined settings the side walls and roof were raised. The installation consists of ten beds of sixes; and the work has been executed in two parts. The first five beds were erected about four years ago, and they were reset last year. The second section of five beds has only recently been completed; and the retorts are now under slow firing, and are expected to be fit for working in a month or two. The retorts are 20 feet in length and 24 inches by 15 inches. The old ones taper 4 inches in their length; but the new ones are on Mr. Herring's Edinburgh section, and are parallel throughout. The coal elevating and conveying plant feeds continuous hoppers holding 120 tons, the filling being accomplished in about ten hours. The charging is performed on the shot-pouch system of the New Conveyor Company; and, in fact, the whole of the work has been carried out by that Company. The coal used is South Yorkshire; and no trouble has ever been experienced with it. The yield of gas is about 10,400 to 10,500 cubic feet per ton; and the total productive capacity of the installation is a million cubic feet per day. The fuel used is something like 17 per cent. of the make of coke.

The visitors first ascended to the charging-stage, and inspected the feeding arrangements; and then, descending, they watched the discharging of the retorts. Only one man was looking after the discharging work; and it was observed that he had to give the charges a little gentle "tickling" to induce evacuation. But it was not of any great moment, and let it not be overlooked that one man sufficed. We have it from Mr. Brown that, in his opinion, the retorts are everything that is satisfactory, and he cannot speak too

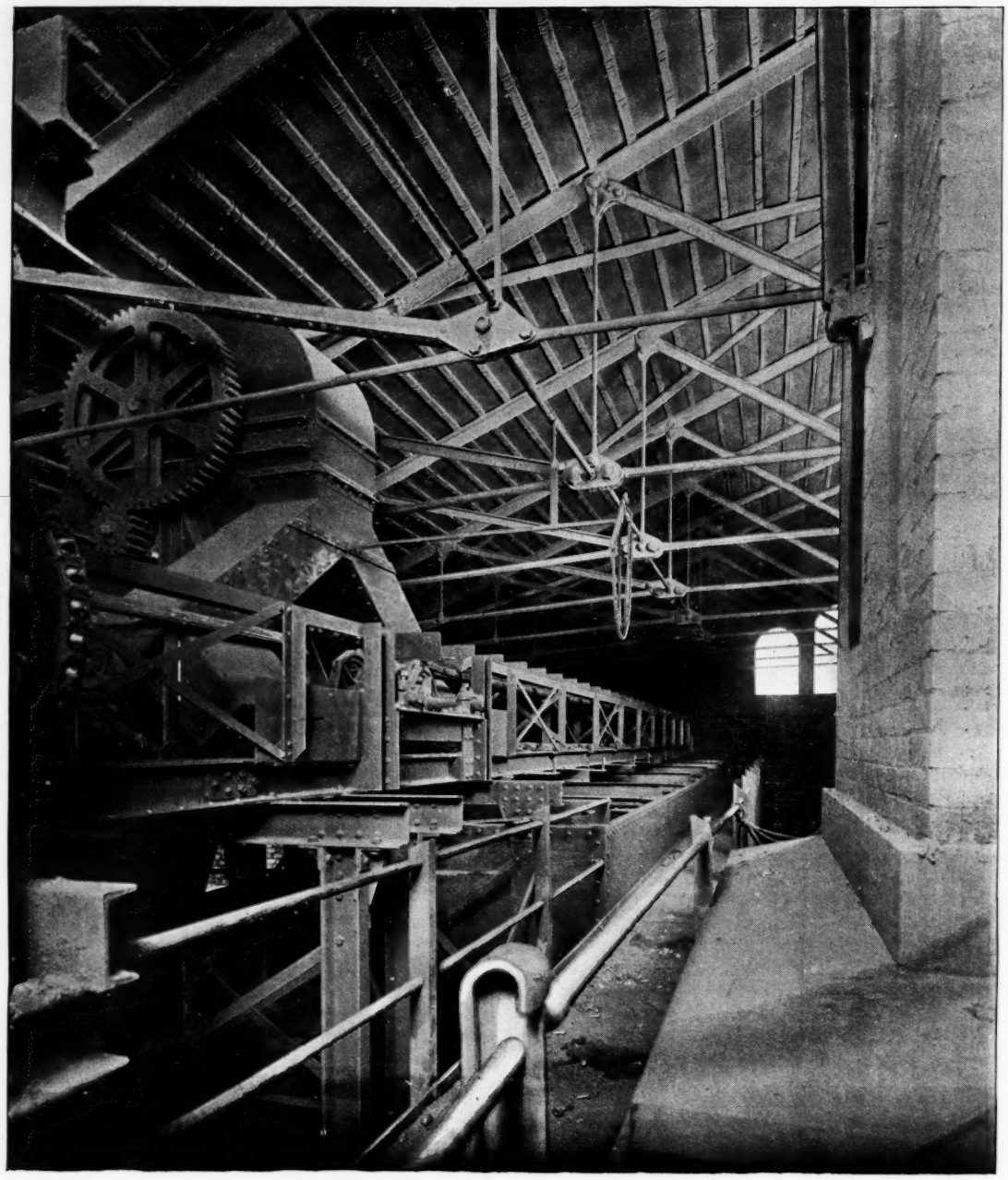


THE NEW INCLINED SETTINGS. OPENING IN FLOOR PLATES LEFT FOR NEW COKE-CONVEYOR.

highly of them. While on the discharging-floor, it was remarked that there are differences between the old and new sections of hydraulic mains. In the case of the old settings, the hydraulic (which by the way is partitioned so that each bed has its own separate hydraulic) is of ⊃ section. At each end of the hydraulic, there is a liquor supply; and this flushes the tar to the centre over each bed, where it is drawn off. In the case of the new settings, the hydraulic main is almost square in section; but the noticeable feature which Mr. Brown has introduced is that the floor of the main is made (in the case of each bed) with a fall to the centre, where it is drawn off—the liquor flush being also used in this case. Mr. Brown's experience is that by the quick removal of the tar, he has no stopped pipes. The conversion of this house to the inclined system has been a heavy piece of work; and the Engineer and Contractors are to be congratulated upon its successful completion.

Leaving the retort-house, the members wandered through the works, and inspected the other changes that have been made in the plant—their general opinion being that the works are now in splendid and up-to-date condition for a provincial concern of the size.

Re-entering their conveyances, the party drove to the Lion Hotel, where luncheon was served. At its close, the President said he desired to express, in the name of the members, their great appreciation of the kindness shown them that day by the Directors of the Gas Company and their Engineer, in allowing them to visit the gas-works. The members all knew what was involved in the extension, alteration, and re-construction of plant on a large gas-works; and they could all appreciate the amount of labour Mr. Brown must have put into his work in order to make the transformation he had effected. Perhaps while he was on his feet, he might be allowed to say a few words as to the autumn meeting. It was contemplated to hold it at Halifax the first week in September. He had the permission of the Chairman of the Gas Committee to say that they would endeavour to make the members as comfortable, and their stay as enjoyable, as possible. In all probability the meeting would occupy two days. Of course, it was a little early to speak yet; but, so far as he could see now, the programme would include a visit to the gas-works, and a dinner in the evening. The next day there would be a drive by way of Hardcastle Crags to the new Washdean Valley reservoir.



Coal-Storage Hoppers and Conveyor.

In conclusion, he asked Mr. Brown to convey to the Directors of his Company the thanks of the members, and to accept himself their hearty gratitude for the kindness he had bestowed upon them that day.

The members very heartily confirmed this expression of appreciation.

In reply, Mr. Brown said he had to thank the members heartily for the kind way in which they had just passed the vote of thanks to his Directors for throwing open the gas-works to the inspection of the Institution, and to himself for what little he had done. He assured his visitors that, when he received a letter from the Secretary asking if it would be convenient for the members to make an excursion to Cambridge, he felt that it was indeed a great honour. He hoped the efforts that had been put forward for their enjoyment in the afternoon would be equally appreciated—in fact, he knew they would be.

The afternoon was very pleasantly spent. First of all the members were permitted to visit the University Engineering Laboratory and the Cavendish Museum. Before passing into the Laboratory, an inscription was observed on the newly-built part, and it brought to mind a lamentable Alpine tragedy of 1898. "This wing of the Engineering Laboratory," it ran, "was erected in memory of John Hopkinson, M.A., D.Sc., &c., and of his son John Gustave Hopkinson, who hoped to have learned here to follow in his father's footsteps. They died on Aug. 27, 1898; the father aged 49, and the son 18." As our readers are aware, this sad accident took from our midst one of the kindest hearted of men, and one of the ornaments of the electrical profession. The Laboratory was found to be splendidly equipped; and a very interesting half-hour was spent there and in the Museum. From here the visitors paid a visit to the colleges. The first one was King's, where they lingered some time in the well-known and magnificent chapel. Trinity College came next; and in turn the chapel was inspected, and the famous dining-hall and library. Time only allowed a rapid walk through St. John's and the chapel. But what was seen of these magnificent and historical buildings gave the visitors great delight. About five o'clock they bid Mr. Brown good-bye at the station; and a few minutes later they were on their return journey to London. Arriving in the City, they parted company; and thus ended the annual meeting.

GENERAL REPORT.

The General Meeting of the Institution was held last Wednesday and Thursday, in the Hall of the Institution of Civil Engineers, Great George Street, Westminster.

Mr. W. R. Herring (Edinburgh), the retiring President, occupied the chair at the commencement of the proceedings.

Election of Members.

The Secretary (Mr. Thomas Cole) read the following list of members who had been unanimously elected :

Copp, Harold E., Gas-Works, West Bromwich.
M'Minn, Arthur C., jun., Gas-Works, St. Pancras, N.W.
Reeson, Joseph N., Gas-Works, Beckton, E.
Reilly, Edward P., Gas-Works, Cape Town.
Smallbone, Fredrick, Gas-Works, Woodford Green, N.E.
Young, William G., Gas-Works, G. N. Ry. Co., Doncaster.

The Amalgamation Question.

The Chairman said, before proposing the adoption of the annual report of the Council and the financial statement for the year, he would ask Mr. Helps, who had been recently appointed Honorary Secretary, to make a few remarks. The Institution had been extremely fortunate in securing his services, and, indeed, it had required some persuasion on the part of the Council to induce him to accept the office; but the value of the help he had rendered in a somewhat similar capacity elsewhere justified him in anticipating a further field of usefulness for the Institution, with Mr. Helps assisting the Secretary. He would ask him to make a short statement, summing up the position on the important question of amalgamation. They would all remember how it was dealt with last year, and what occurred at the subsequent meeting of the Gas Institute. Since then other meetings had taken place, and Mr. Helps would state what was the present position of affairs.

Mr. J. W. Helps, after thanking Mr. Herring for the kind remarks he had made with regard to himself, and assuring the members that it would give him great pleasure to do anything he could to further the interests of the Institution, said he wished the members to notice particularly the manner in which the question of amalgamation was now brought forward. It had been urged in the past that it had been put before them by the Council in such a cut-and-dried fashion that the members had been somewhat hampered in the expression of their opinions. This year, therefore, the Council had thought it better not to propose any definite resolution, but rather to deal with the subject in an historical manner only. When, soon after a conference of the two Councils held some time ago, he received a letter from the President of the Gas Institute, asking that some written notice of it should be taken, and sent to the Gas Institute Council, he replied that the suggestion mentioned in the report, which formed the principal part of the business, was not a proposal from the Committee of the Institution, but was rather an individual suggestion. It might be as well to refresh the memories of the members by a reference to the resolution proposed and carried last year—viz., "That the members of the Institution of Gas Engineers approve of the action of the Council during the negotiations for amalgamation with the Gas Institute, and much regret their inability to accept the proposals of the Council of the Institute, as contained in their letter dated February 26, 1901." This letter practically objected to the three main principles involved—(1) The dissolution of the Institute, (2) the suggested change of name, and (3) the exclusion of any of the existing members of the Institute. A suggestion was made at the meeting that all Past-Presidents of the Institute should be retained as members; and also that those who, by their past services to the industry, had shown themselves capable of rendering great assistance, should be adopted as members by the Council, if approved by the members. In June following, the Gas Institute held their meeting, when a resolution was passed—"That this meeting endorses the efforts of the Council to bring about an amalgamation of the two Societies, and, while reaffirming its opinion that amalgamation is desirable, requests the Council to continue their efforts to bring this about, on the basis of the inclusion of all classes of existing members of both Societies." It naturally appeared to the Council of the Institution that this resolution was so diametrically opposed to the principles on which the whole negotiations, more especially in the early stages, had proceeded, that the door was shut, and that nothing further could be done. Shortly afterwards, however, it was suggested that a joint conference should be held, to talk the matter over, and see if some *modus vivendi* could be arrived at. It must be remembered also that in July a letter was written by the Secretary of the Gas Institute to the Council of the Institution, stating that his Council were of opinion that there were some names on the roll of the Institute which it would be desirable to exclude, but at the same time there were others which should be retained, but who would be debarred if clause 4, as it was originally framed, were to be passed. A reply was sent appreciating the truth of these statements, and suggesting that the two Councils should agree on the names of those whom it might be considered desirable to include. In reply to this, the Secretary of the Institute forwarded a copy of a resolution passed by their Council, stating that such a course presented great difficulties, and they considered it unadvisable to adopt it. It would be seen from this that the Council of the Institute had departed to a considerable extent from the principles they at first laid down, inasmuch as they were ready to accept certain members, who, though traders, might be of service to the Institution. On Feb. 15 last, the two Councils met in that building, and naturally the main point which came up for discussion was the inclusion of traders. In the first place, one or two members of the Gas Institute seemed very averse to departing one iota from the resolution which had been passed at the general meeting, that negotiations were only possible on the basis of including the whole of their members. In the course of conversation, however, a suggestion was made that it might be possible to get over the difficulty, and avoid the naming of certain members, if a list were prepared, after careful consideration, of those who would be ineligible both in the Institute and in the Institution—if there were any—under the new rules; that then, by resolution, a certain number, or certain percentage should be decided upon, who might be elected; and then that the list of these so-called "ineligibles" should be sent round to every member of both Societies, and a vote taken, when those receiving the greatest number of votes up to the number fixed upon would be elected and retained on the list of the new Association. At the same time, it was suggested that all those who had been gas engineers or managers, but who had left their positions and gone into trade, and also all secretaries who were acting solely as secretaries of gas companies, should be retained, without any ballot. This was simply a suggestion, and was not put forward as a recommendation from the Council. A considerable amount of discussion took place as to the number to be fixed upon; but nothing very definite was suggested. Of course, the members who would be principally concerned were the extraordinary members and associates, though one or two full members of the Institute would also be affected. The matter now came forward for open and free discussion; and he did think that, whatever was done, something should be settled to put an end to the present most unsatisfactory state of affairs. The suggestion which had been made might meet with the approval of some, but he thought it would encounter the disapproval of many others. He would also ask the members to give this matter full consideration, if only for this reason: It could not be expected, even if the suggestion were favourably received, but that it would be opposed by a considerable minority; and if it were carried, what would be the result? It seemed to him that the minority could scarcely remain in an Institution which carried a resolution so absolutely opposed to the principles which were adopted at the very beginning of the negotiations; and it therefore appeared to him that, if such were the case, the position which would exist with the Amalgamated Society would be very little, if any, better than that which existed some years ago, when the unhappy secession from the Institute took place. He need hardly say anything more. He did not wish to express any individual opinion, but merely to recall the history of the matter, so that members might be in a position to give their opinions on this very vexed question.

Mr. H. E. Jones (London) said he had recently been in conversation with Mr. Woodall and Mr. Hunt, when this matter was discussed; and he had been led by their opinion, as much as by his own, to formulate a policy with regard to it. No one could be more anxious than he was to bring about a union with the Institute, so that they might present to the world a strong Association—broad, catholic, and entirely representative. No narrow spirit of jealousy or personal feeling of any kind should intrude, because the art

they all served was a very long one, and life was very short; and they could not do better than strengthen themselves by alliance with those having common interests. But there was a certain classification essential in their ranks. First of all, there were those so clearly described by Mr. Holgate as being people whose stock-in-trade was their brains; and in this class he should include all present. Then there were those whose stock-in-trade was material goods which they wanted to sell; and they were properly termed traders. But, again, there was a smaller class who combined both brains and goods; and they were all aware that this class comprehended men of the highest scientific attainments. It occurred to him that it would be well to follow the example of the great Institution within whose walls they were assembled, who, exclusive as they were, admitted into their ranks those men occupied with trade who had distinguished themselves in the scientific world. The names of Whitworth, Armstrong, and Lord Kelvin were constantly heard in those rooms. Lord Kelvin they knew had a place in Glasgow for the sale of his instruments; and he was a partner in a concern for the disposal of these things. He, like Sir William Armstrong, Sir William Arrol, and others, and quite deservedly, derived a large income from the sale of his beautiful inventions, and from his works. It struck him, therefore, that it would be well to avoid what they were asked to do in the suggestion which had been made—to take on themselves the very odious and invidious task of picking out certain people who were ineligible. He objected to the word "ineligible," and should much prefer to go on the line of election, or selection. It appeard to him that the whole difficulty might be got over (if both sides were really anxious to bring about an amalgamation), if they would agree "to admit as honorary members—a class which already existed—such members of the trading community as should, in the opinion of a clear two-thirds or three-quarters majority of the Joint Councils, have rendered definite services to the profession of gas engineering, or specially promoted the interests of the gas industry. This would enable them to pay a great compliment to the trades which were allied to the gas industry, and to create a class—which need not be at all small—to join which would become the legitimate aspiration and ambition of traders. At the same time, it would serve the purpose about which they were all rigorously determined—that they would not, *qua* a scientific association, have their meetings and proceedings invaded by gentlemen who were purely traders, and who could not help their scientific discussions in any way whatever. He hoped this might form a *modus vivendi*, and get over the difficulty which he felt as acutely as anyone. It would be most improper to exclude a considerable number of gentlemen who had rendered most valuable services to the gas industry, but who were essentially traders. Where a trader showed that he had brains, as well as goods, to sell, he was worthy of admission; and in order not to create any further invidious distinctions, he would make it a complimentary membership—a class by itself—and not make it too limited or narrow. He would move a resolution in the sense he had indicated; and he hoped it would be seconded by someone more influential than himself, and meet with the support of the meeting.

Mr. J. L. Chapman (Harrow), as one of the original seceders and Hon. Secretary of the Institution in its early days, seconded the resolution. He thought the remarks of Mr. Jones were very much to the point. They all felt that it was necessary to maintain the position they took up originally; and, at the same time, they wanted to hold out the olive branch to the Institute in every way they could. The influence of scientific traders upon the gas profession had been manifold; and it would be a serious loss to lose them. But at the time when they had to break away, it was difficult to make distinctions, because the question was very pressing; and they felt that the trading element must be got rid of. To-day they stood on a different platform; and it seemed to him that it was possible, if both sides acted with kindness and courtesy, to bring this matter to a conclusion. He had much pleasure, therefore, in seconding the proposition of Mr. Jones.

Mr. Charles Hunt (Birmingham) said the position had been so admirably defined by Mr. Jones and Mr. Chapman that he felt it quite unnecessary to do more than say that the proposal had his hearty support. He felt that something ought to be done by way of consulting the various interests involved; and it seemed to him the mode proposed by Mr. Jones would meet the difficulty in a very satisfactory manner. There was only one reservation he should like to make with regard to it, and it was this: It was suggested that the selection should be by two-thirds or three-fourths of the new Council; but he would prefer to leave it entirely open to the new Council to decide it.

Mr. George Livesey (London) said he would support the resolution; but he would make this further *addendum* to it—that the Council should select or nominate the honorary members, but that the election should be made by the general body. He did not know whether his friend would accept that; but he thought the general body should have some voice in electing or selecting the honorary members. In reference to the suggestion of making a list of names and giving a vote by ballot to all the members, it was quite absurd; and he could not understand how any men in their senses could have proposed such a thing. To imagine that they—anxious as they were for unity and to present a united front to the gas industry and to the world—would sacrifice their principles in the way suggested by the Gas Institute, was rather too much. He would go further, and say that the union of the gas industry into one great and united body was most essential; that, as far as the Institution and the Institute were concerned at present, they were very pleasant and very useful in bringing men together and promoting friendships, but as far as the good they were doing to the gas industry was concerned, it was *nil*. He was not at all sure whether the gas industry would not be better without either the Institution or the Institute as they were at present. [Several expressions of dissent.] At any rate, he should like to know what good they were doing. They performed some good by promoting friendly intercourse, but as far as doing any good to the gas industry was concerned, it was practically *nil*. What they wanted was to have such a body as could speak with authority. For instance, there was an Association called the Gas Companies' Protection Association. Why should that be necessary? Why should not a body representing the whole of the gas industry have, as part of their duty, the watching of the interests of the industry in Parliament and elsewhere? He did not much like to mention it, but there was a little matter in which he had been recently engaged, and if there had been a body representing the gas industry they would have taken up the Welsbach matter and brought it to a successful conclusion. As it was, it was merely left to chance. While he was quite willing to make every possible concession, there was one he could not see his way to grant—and that was to throw overboard all their principles, and come in under the terms suggested by the Gas Institute.

The Chairman said he must inform Mr. Livesey that the suggestion which was the result of the joint conference came from the Institution rather than from the Gas Institute.

Mr. Livesey said in that case he was sorry he had expressed himself so strongly; but he could not agree with the suggestion. He was anxious to see the gas industry united, and supported the proposal of Mr. Jones, with this addition—that the Council should select the names, and that they should be submitted to the general body, as was done in the old British Association. There were honorary members then. Two traders were made honorary members—Mr. Sugg and Mr. Hartley, both men who had rendered great services. Neither of them could become a member, because they were both traders; but after many years, the Association, on account of their great services, elected them as honorary members. He believed their names were submitted by the Council, and they were subsequently elected by the general body.

Mr. Jones said he had no hesitation in accepting the amendment that, while the names should be selected by the Council, the election should be carried out by the members. He thought it was an improvement.

The Chairman asked if Mr. Jones suggested that the Council should select the names by any particular majority.

Mr. Jones said he thought there ought to be a two-thirds majority. It would strengthen them in making a selection, which was, after all, a delicate matter.

Mr. T. S. Lacey (London) said, if he understood the proposition, it was that a number should be selected by the Council, out of which a smaller number would be elected by the members.

Mr. Livesey said no. He meant that individual traders' names should be selected by the Council, and then submitted to a vote.

Mr. Lacey said, in that case, suppose some of them were not elected by the members, their names would be removed.

Mr. JONES thought the two-thirds majority had better be shifted from the Council to the members, that the list should be selected by an ordinary majority, to be elected by a two-thirds majority of the members present.

Mr. CHAPMAN said he had seconded Mr. Jones's resolution; but he could not agree to this alteration. He would rather have maintained the orignal resolution, that the two united Councils, as they stood to-day, should meet together and nominate certain members to the position of honorary members. Two-thirds of the Council should be in favour of the persons nominated. Mr. Livesey's proposal was that the nomination should be afterwards submitted to the members of both Institutions for a ballot; but he himself thought that the resolution ought to stand as it was originally proposed.

Mr. JONES said that, on consideration, he did not feel at liberty to grant the concession he had just made. He consulted so many people about it that he did not feel personally at liberty to enlarge the proposition; but he would accept Mr. Livesey's suggestion that the list should be voted upon in the ordinary way.

Mr. LIVESEY thought they ought to guard the admission to this class very carefully, and that a two-thirds majority should be retained in the voting of the members.

Mr. CHARLES WOOD (Bradford) said that, with all respect to Mr. Livesey, in his opinion his suggestion would have the very opposite effect to that which he anticipated. If the names were to be selected by the Joint Council, for all practical purposes they were elected by the Councils. As a matter of form, they would go to the members of both Institutes; but every member selected by the Joint Council would be elected by certainly two-thirds or three-fourths of the whole body of members. Seeing that the membership of the Gas Institute was so very much larger than their own, he did not see how submitting the selected names to both bodies of members could possibly eliminate the trading element. He should rather the resolution remained as at first proposed.

Mr. HUNT said he felt very strongly that there should not be any special provision for the election of these members. It might appear invidious. The ordinary rules ought to suffice. If the united Council were specially elected by the two bodies, surely they could be entrusted with the selection of these members in the ordinary way; and he thought it undesirable that there should be any condition attached to the election in the manner proposed.

Mr. T. B. BALL (Rochdale) could not quite see where they were drifting. Some time ago, they set their faces against the inclusion of traders in the Institution. Now they were not only welcoming them, but setting a premium on their election by making them honorary members, so that they would occupy a better position than the members generally. If they were not anxious to include the trading element, why were they changing their position in this way?

The CHAIRMAN said he believed they were all agreed that it was very necessary to bring about amalgamation if it were at all possible; and Mr. Jones's resolution was a way out of the difficulty which was blocking amalgamation at the present time. This was why they seemed to have changed their position.

Mr. BALL said it seemed to him the position which had been held up to now was to be given away in order to effect amalgamation.

The CHAIRMAN thought the resolution without any suggested alterations would fulfil the object in view. The real difficulty was to bring about amalgamation, and to appease a certain number of men at present members of the Gas Institute, who would otherwise be left out in the cold. The resolution left it to the Joint Council that might exist at the time of the amalgamation to select, by a two-thirds majority, a certain number of these gentleman. Afterwards, they might probably extend the Articles of Association so as to perhaps carry the spirit of the resolution a little further with regard to traders who had specially promoted the interests of the gas industry. The resolution as originally proposed was this: "To admit to the class of honorary members such members of the trading community as shall, in the opinion of a clear two-thirds majority of the Joint Council, have rendered distinguished services to the profession of gas engineers or have especially promoted the interests of the gas industry."

Mr. WILLIAM FOULIS (Glasgow) asked if there was any number to be fixed.

The CHAIRMAN said no, that was left to the discretion of the Council. They did not propose limiting the powers of the Council at all.

Mr. J. C. BELTON (Chester) asked how it was proposed to make the resolution effective. At present, there was an existing membership in the Institute; and he did not see how the ground was to be cleared for the resolution. What were they to do with existing members of the Institute?

The CHAIRMAN said that was a matter entirely for the Gas Institute. It appeared to him they could do it only by dissolution. This resolution was really the terms upon which the Institution were prepared to proceed with amalgamation. If the Institute accepted it, they would devise their own means for bringing it about—most likely by means of dissolution.

Mr. S. MEUNIER (Stockport) said that, as regarded the necessary steps to be taken, he understood this was going to be left entirely to the Gas Institute; but had due thought been given to the position of affairs? As he understood it, both Societies intended to dissolve, and then to form a new one out of the ashes of the two. Supposing the resolution were carried—which was certainly very desirable in more ways than one—then the new Council, by selection, would form the nucleus of a body of honorary members. But the others would simply be asked to submit to the happy despatch, and stand on one side. As a matter of fact, this had been the whole trouble all the way through—this very difficulty of picking and choosing so as not to hurt the feelings of others—and he should like to have some idea of what steps were proposed to be taken to avoid trouble in future. He also thought the matter had not been looked at from the legal standpoint, to see whether the various associates who would be left out could take steps to spoil the whole matter. There had been one case before; and the question was whether there was a probability of the same thing occurring again. Looking through the Articles of Association of the Institute, he certainly did not get any enlightenment upon it one way or the other; but it appeared to him quite probable that a few who might like to take the trouble and spend the money, could make a great deal of difficulty and in all probability prevent the amalgamation going through.

The CHAIRMAN said this matter had had very close consideration all the time. It was rather a question for the Gas Institute whether they were going to allow a small minority to regulate the business.

Mr. MEUNIER remarked that the point was, could they prevent them?

The CHAIRMAN said it was a legal question which he could not answer.

The HON. SECRETARY said this point had been raised when they saw their legal adviser some time ago, which was in the early stages of the negotiations; and he told them that, provided the two-thirds majority required for a dissolution could be obtained at a meeting, none of the members after that would have power to raise any such difficulty as Mr. Meunier suggested. That was, of course, if it were confirmed by special meeting.

Mr. E. A. HARMAN (Huddersfield) suggested that all the member swere heartily sick of the amalgamation question. They seemed in a very unsettled state. It came up year after year, and they did not get the least bit nearer to the goal. He thought perhaps the Institution would be well advised to let the matter remain in abeyance for the present, and that a little rest would be useful. He would therefore propose, as an amendment—"That the matter of amalgamation be allowed to remain in abeyance for the present, and that they proceed to the ordinary business."

The CHAIRMAN having inquired if anyone seconded the amendment, to which no response was given, he declared it to be lost; and said that, if agreeable, he would now put the resolution.

Mr. W. E. PRICE (Hampton Wick) asked if the vote to be taken would be a bare majority. It was a question worth consideration. As had already been suggested, unless the feeling of the Institution by a large majority was in favour of it, it would really not be a success, as the minority, if considerable, would have a feeling that they would not be able to remain in the Association which would then be formed.

Mr. FOULIS asked how many members there were on the Council of the Gas Institute, as compared with their own number?

The HON. SECRETARY said they were 17 to 14.

Mr. FOULIS said if there were a great number of members,

who might be called objectionable members, proposed as honorary members, the membership of the Institute was so much larger that they of the Institution would be completely swamped, and would have no power as a body.

The CHAIRMAN said it was proposed that it should be left to the Joint Council to decide by a two-thirds majority, and that their selection should not go to the members. There would be no power to propose other names, except through the Council. He thought this would be fair to both parties. With regard to the present voting, it was simply a question of a majority; but there was no doubt that the larger the majority the greater influence it would have upon the Councils and upon the action of the Gas Institute.

The resolution was then put, when 42 hands were held up in favour of it and none on the contrary.

The CHAIRMAN therefore declared it carred *nem. con.*

ANNUAL REPORT AND ACCOUNTS.

The CHAIRMAN then proposed the adoption of the report and statement of accounts which had been circulated. He said the latter were very satisfactory; the balance in hand being more than it was on the previous year's account.

The HON. SECRETARY seconded the motion, which was carried unanimously.

The CHAIRMAN said his next duty was to call upon the new President, Mr. Thomas Holgate. It would be quite presumption on his part to introduce him to the Institution, for his record in the proceedings was such that it was rather a favour to the Institution that he should accept the office, than an honour to himself. He was known for his indefatigable labours, and had carried out a considerable amount of research work.

Mr. THOMAS HOLGATE, M.Inst.C.E. (Halifax), the new President, then took the chair.

Mr. W. KING (Liverpool) said he had to move a resolution which he was quite sure would be carried unanimously —that the best thanks of the meeting be given to the retiring President, Mr. Herring, for his services to the Institution during the past year. Very few words were required in moving this resolution, because they must all remember, not only the special services which Mr. Herring had rendered as President during the year (which was one of very considerable anxiety, involving close attention to their interests), but his kindness and hospitality on the occasion of the visit to Edinburgh and the immense satisfaction they all felt at the inspection of the great works which he was constructing there.

Mr. A. E. BROADBERRY (Tottenham), in seconding the resolution, said they were all grateful to Mr. Herring for the manner in which he had fulfilled the duties of the Chair, by which he had certainly given additional prestige to the Institution.

The PRESIDENT then put the resolution, which was carried unanimously, with cheers.

Mr. HERRING thanked the members for the very hearty manner in which they had responded to the vote of thanks so kindly expressed by the proposer and seconder. He said he had felt it a great honour to be President of the Institution, and had, in his small way, endeavoured to promote its interests.

Mr. HOLGATE then read the following

INAUGURAL ADDRESS.

The first words I use must be an expression of thanks for the high honour which you have placed upon me. No position that is at the disposal of his professional brethren can be so much appreciated by any gas engineer as this presidential chair. When acceding to the wish of the Council, I could not conceal from myself my inexperience for such an office; but a desire to serve the Institution in every possible way determined me to yield, relying upon the co-operation of all its officers and members.

The future of any industry, although it depends largely upon those who conduct it, must, in the last resort, depend upon the cycle of operations upon which it is based. The relative importance of the active and passive factors may not always be apparent to a superficial observer; but these factors are constantly in operation, and they act and react so that in physical or chemical processes the best commercial results are only attained by the most perfect use of the natural laws that are for the time being known to us. The highest attainment is the "qualitative and quantitative analysis of physical science multiplied by the figures of commercial values." The more perfectly we understand the materials and forces of Nature, and the more skilfully we direct them to the end in view, the more certain are we of an enduring success—a success that is less disturbed by side issues, by fluctuations of market prices, or less dependent upon the extent of the advertising that is given to the industry, its wares, or their uses. These fundamental considerations have, I believe, been exemplified in the history of the gas industry—in its broad issues as in its recent expansions; and they will reassert themselves in the future developments which are near to us. They will help us to distinguish between proposals which are merely for the hour and those which have the promise of future potency.

To see them clearly may be helpful, and may enable each of us to go forward with confidence when we feel that in extending our several undertakings we are but enlarging an edifice which rests upon secure foundations. That the gas industry is based upon a cycle of operations which is, upon the whole, a good one, is evidenced by its long and continuous success, by its awakening from the sleep of monopoly, by its invigoration in the face of competition, and by its integral part in the service of the commonwealth. Its ministry to the general good is only faintly indicated by the dividends or profits that gas authorities have received, although these are probably without parallel in any public undertaking. The competition of the last decade is often credited with arousing the energies of the gas authorities; but it is not so often recognized that it has also revealed the strength of our position. During that period, have we not witnessed the growth of an industry in which the problems of our own predecessors were reproduced? The questions of generating plant, of duplicate machinery, of costs of working, of storage, of unequal demands from consumers, of leakage, and many others, have been discussed under new conditions; and our friends discovered that the way had been trodden before, and that it was unlikely that our existence would be so speedily terminated as enthusiasts had proclaimed.

If the analogies that I now proceed to employ introduce our friendly rival, electricity, it will be without any wish to disparage it, but only as a convenient way of bringing to our minds the questions involved by the illustrations of practical experience. Each agent has its own sphere of advantageous operations, arising from the fact that in supplying gas we are selling a material—potential energy; while in supplying electricity it is a force—kinetic energy. We can therefore wish well to electricity where it can be proved to be better than gas; while, similarly, we strive to serve most and best in those spheres where we can have the pre-eminence. Further, the lessons that I desire to learn by this inquiry are not possible unless we assume coal to be the starting point in each case. If the natural forces of gravity, of the winds, or of the tides, were harnessed to the dynamo, then other factors would enter into the case; and we, as gas engineers, must therefore remember that, although the first comparison should issue almost entirely in our favour, there are still elements of competition in reserve which we ought not to forget. Denied the aid of the natural forces, the electrician longs for the day when his commodity can be made direct from fuel, hoping that this transformation will be immensely superior to the one he is now compelled to adopt, as by employing the steam-engine as his motor he must reject nine-tenths of the heat from the coal into the exhaust. We envy his beautiful buildings, filled with the finest machinery British engineering can produce, and compare them with our dusty retort-houses; but after these æsthetic considerations, there come to us the physical and commercial. In the process of carbonization, by means of 12 per cent. of the heating power of the coal, we obtain 34 per cent. as gas and valuable volatile matter, while the remainder is of a thermal and commercial value scarcely less than before. We get our agent in a way very much akin to the ideal—viz., direct from Nature—with a high efficiency in the process. Nor is this advantage in manufacture the only one. The fact that gas can be stored increases the productive capacity of the plant, by reason of its continuous operation equally throughout the twenty-four hours. What little storage our friends can accomplish is hedged about by so many losses and limitations that they confess that "practically electricity cannot be stored."

Before leaving the manufacturing section, a secondary matter must not be omitted. The whole of the fuel used in the electricity generators appears at the top of the chimneys, in the form of carbonaceous gases, soot, and sulphur; while

at the gas-works chimneys only the sulphur from 12 per cent. of the coal employed is emitted, and that without soot. The gas that is sold has been deprived of almost all its sulphur, and thus the atmosphere is preserved from pollution; while this great public gain is accomplished at a cost which is so small as to be negligible in comparison. In the matter of distribution, too, our advantage is not disputed. Mr. Denny Lane showed, in the early days of electric lighting, the infinitesimal cost of sending gas through a long length of mains; and the improvements since then in electrical distribution by high-pressure currents still leave the supremacy unimpaired.

So far, then, as can be seen at present, there is no immediate likelihood of our superiority at the threshold of the consumer's premises being disturbed. In the practical application of the two agents, the comparison is more involved, because æsthetic considerations are often as influential with the wealthy as financial ones are with the less favoured multitude. In supplying heat, we can furnish with economy all the essentials; while electricity can offer only the advantages of portability and beauty of appliance, but purchased, of necessity, at a cost that is extravagant. In supplying motive power, the electrician can make out a better case than in heating or cooking; but inasmuch as a comparatively small gas-engine will give a thermal efficiency of 30 per cent., against 15 per cent. for the steam-engine which he himself has employed, and as all other costs are multiplied in proportion, he must admit that the cost of current to the user will be four times that of gas.

The most successful of the applications of electricity—viz., tramcar propulsion—is not proved to be more economical than gas traction; but, on the contrary, the success is entirely due to the smoothness of running, in which respect, up to the present, I regret to say, electricity holds the palm. Is it too much to hope that gas may soon have a larger share in serving tramways, and doing this with undoubted advantages both to the appearance of our roadways and the pockets of the ratepayers?

Continuing the comparison into the domain of lighting, we still have ground for encouragement. What other methods of developing the lighting value of gas may hereafter be devised we need not stop to discuss, as the incandescent system is the one upon which our energies must now be directed and our calculations based. We are all familiar with the comparisons of cost that are made between electric arc and incandescent gas for street lighting; and when an illuminating power of 24 candles per cubic foot of gas is predicated, the result is unmistakably in favour of the latter, both in cost and efficiency, while these are still more marked when glow lamps take the place of arcs. But we have every reason to believe that 24 candles per cubic foot will soon be regarded as a minor achievement, because we have one lamp in our midst—the Lucas light—in which 41 candles per cubic foot are claimed, and which, I can confirm, is realized.

Leaving for the time being the question of lighting, I may conclude this portion of my address by saying that should the consumer of gas desire to use electricity for any purpose, he can obtain it on his own premises, by means of a gas-engine, cheaper than he can get it from an electric supply company. This sums up in a nutshell, and yet very significantly, the advantages the gas industry to-day enjoys.

If the sketch of the events of the past decade which I have faintly outlined be at all worthy, it will, I believe, have shown by implication the importance of maintaining a high heat efficiency in all the operations of gas making and using. A like result would have been obtained had our investigations been directed towards Mond gas, or indeed to any proposal for distributing power from a central station. A study of the plant and of the cycle of operations of the Mond system would have given us an example of chemical engineering employed most skilfully in carrying out the counter-current principle. By the thorough application of this method (which is peculiarly applicable to gas matters), the great problem of ammonia recovery from fuel has been solved, and that in an economical manner, solely by reason of the high heat efficiency of the process. I believe that in our operations many internal economies are possible, and that in seeking to obtain the best results we may often make use of the counter-current principle. We already employ it in the recuperators attached to our retort-settings; but this, perhaps, should be regarded as an imperfect application. The true aim is to so order the sequence of operations that, while performing their several duties, they shall in themselves be acting in a scale of ascending or descending temperatures; in other words, the sequence in itself should be recuperative, without the aid of extraneous appliances. As our supremacy cannot seriously be questioned in matters of storage and distribution, it is evident questions of heat efficiency and working expenses largely centre in the retort-house, &c., of the manufacturer, and in the gas engine and burners of the consumer.

With these facts in mind, I must now try to indicate what are the methods of working which the experience of the past and the needs of the present show to be most desirable; in other words, my aim is to see whither the logic of events in the gas world is leading us, and how far each line of progress may have its limitations or its possibility of further extension. To do this, I shall endeavour to outline a gas-works embodying the leading principles that appear now to prevail, in order that this may be a nucleus around which thoughts may gather. This, however, must be prefaced by a series of explanations.

(*a*) In days gone by, and again at the present time, there have been proposals to carbonize coal in vertical retorts, in rotating retorts, and other large departures from ordinary methods, that may in due time eventuate in better results than we can foresee. My look ahead does not take in the distant scene; it is concerned only with making the best of ascertained advantages, and co-ordinating them to produce the best results in the next step forward. In conformity with this idea, I must express the opinion that, in general, the ordinary routine of a gas-works carried through, mechanically and chemically, in the most economical manner will be found to be the best; and that any deviation from that cycle must be directed towards meeting the disease requiring the departure with a cycle of equal efficiency.

(*b*) The most cogent reason up to the present for any departure from the ordinary cycle, is the difficulty of dealing with the surplus coke. In small works, and up to a certain limit in larger ones, the difficulty does not become acute; but when the local demand for coke (after due attention to its cultivation) is not sufficient, then the very growth of the gas supply provides a hard fact that must be faced. We then see that to have to deal with such a large percentage of raw material, as something inert, for the production of our principal commodity—gas—is a serious element, and that it must be dealt with on lines that are sound. The problem may be met in two different ways: (1) By making a class of coke which is more readily saleable, and such as is required in blast-furnaces and cupolas; (2) by using coke in making water gas, carburetted or otherwise.

The first of these alternatives has been discussed on the initiative of our Past-President, Mr. Charles Hunt, M.Inst.C.E., and more recently at the admirable Congress held in Glasgow last autumn. The coke-ovens at Rothwell, in the West Riding of Yorkshire, have been open to my inspection, and information respecting their working has been furnished me. The general result is very satisfactory; and it appears to me that in the neighbourhood of collieries, where washed slack can be obtained, the system ought to be a useful and profitable one for the various gas authorities. As they would probably retain their ordinary gas plant, installing the coke-ovens to meet growing demands, they would derive the full advantage of improved market prices for the two classes of coke, the tar, and the ammonia. This would follow by removing an outside competitive producer of the bye-products; and, all things considered, there would be a good return for the capital invested. The working of coke-ovens is, after all, but a modification of our usual methods; and as we are assured there is no perceptible falling off in the gas produced per ton of dry fuel, and also that the ovens can be heated by the producer gas, there is no reason why these ovens should not be adopted to redress the anomalies of the coke market.

The necessity for separating coke-oven gas into two portions does not now exist, as the whole of the production is quite suitable for use in the incandescent system; and the heating of the ovens can be done by Mond gas or producer gas, and all steam required obtained from the waste heat *en route* to the chimney. A recent improvement—compressing the charge before coking—is stated to increase the range of coals suitable for yielding good coke; while it increases the productive capacity of the ovens, by doing away with the arduous labour of the levellers, and working at a lower cost in general, after payment of the higher capital figures required by the extra mechanical charging-machine with which the compressor is combined.

The experience at Brymbo by Mr. J. H. Darby, and at Winnington by Messrs. Brunner, Mond, and Co., Limited, has extended over many years; and in both instances the surplus gas has been used for illuminating purposes in the works and surroundings, so that there should be sufficient data to prevent any error in the future extension of this system. Several firms are in existence in this country erecting coke-ovens upon somewhat similar lines, and many of them are willing to construct them on the deferred payment principle —taking each year, for an agreed term, a portion of the profits. This shows confidence in the system; and as the demand for metallurgical coke is large and increasing, and the price a good one, the coke-oven method should be seriously considered by those who are in a favourable geographical position.

The second alternative will probably be found the one most generally applicable, as it is independent of nearness to the supplies of washed fuel, or to the consumers of metallurgical coke. It has been shown, in former proceedings of this Institution, how wasteful of heat is the manufacture of water gas, when the producer gas alternately made with it is not fully utilized; and notably so when it is conjoined to a carburettor in which oil is gasified by an intermittent process. If, however, these serious drawbacks are eliminated, then a high efficiency of heat is possible; and this view is incorporated in the working of a coal-gas plant as will be hereinafter described. It is further contemplated that the steam so used shall be exhaust steam or the waste gases from sulphate of ammonia manufacture, containing steam, carbon dioxide, and the minimum of sulphuretted hydrogen.

(*c*) When, last year, a proposal for 10-candle gas was made before this Institution, few would have forecast the amount of support which the idea has already received; and bearing in mind the natural fears that were expressed respecting such a departure, we may reasonably expect that if once parliamentary sanction is obtained, the least disturbance to consumers and manufacturers would be occasioned by a few steps of 2 or 3 candles each rather than by smaller ones, which would cause more frequent adjustments. I think the fears that have been expressed about the relative costliness of 10-candle gas are based upon a wrong data as to the average cost of materials taken over a period, and also as to the charges for capital, manufacture, distribution, and management per 1000 cubic feet, and also upon insufficient knowledge of the incandescent system as affected by temperature and quantity of heat.

If 10-candle gas is to be distributed, we shall require to settle upon a method of manufacture that shall yield a fairly uniform mixture, as regards calorific power, flame temperature, and air required for combustion. Possibly 70 parts of coal gas of 14-candle power with 30 parts of "blue" water gas might prove a desirable mixture. If, however, it is found necessary to add hydrocarbons to either of the components of the mixture, or to the mixture itself, then preference should be given to those methods which employ the series taken from coal tar. For although the price of petroleum oils is, of course, subject to the law of supply and demand, yet the facts that it is controlled by a very small number of persons as sellers, and that we are such a long way from the sources of supply, tend to produce conditions that do not give confidence to the users. Nevertheless, we must be equipped so as to take advantage of oil when conditions are favourable; and though the prospect is that less instead of more will be required in the future, yet in that way we shall obtain the elasticity to meet either coal, oil, or labour famine.

(*d*) One of the chief hindrances remaining to economy of labour in retort-houses using mechanical stokers or inclined retorts is the filling of the furnaces with the freshly-drawn coke; and it is apparent, by recent applications of outside producers, such as we have had the pleasure of inspecting recently at Dawsholm, and which are also in use at several works of the South Metropolitan Gas Company, that a considerable improvement is possible over inside producers, and also that where hot-coke conveyors are installed these can be conjoined with distinct advantage. I have shown (pp 1177-78) in the sketch plan the whole of the red-hot coke being taken by conveyors to a series of producers, and therein the sensible heat being utilized, emerging, after contact with the ingoing steam, in a dry quenched condition. The series of producers could produce gas for heating the retorts only, or such a proportion of water gas could be made therein as desired, and collected separately. In this part of the proposal, there is full opportunity for the counter-current principle—the coke going in hot at one end and coming out cold at the other; while steam or air entering at a low temperature would emerge at the other end at a high one.

To test what would be the properties of coke after passing such a process, a laboratory experiment was made, gasifying 18 per cent. of the coke, with the result that there was a diminution in the volatile sulphur from 2·90 to 2·24 per cent., and of the selenium from 28·5 to 22 parts per million, or from 0·00285 per cent. to 0·0022 per cent. This test showed that the sulphur and selenium were gasified much more quickly than the carbon. These facts are, however, but ancient history to those who know what has been done on similar lines in the metallurgical fuel world. It is also known by those users of fuel who must have it free from sulphur that gas coke which has passed through a fire is benefited by the process, both in regard to impurity and to texture. A similar improvement would find favour with the maltster and brewer. It is also worth noting here that the makers of coke in the bye-product recovery ovens find that the appearance of their coke is depreciated when excess of water is used, and that the brightest aspect is given to it by a small quantity of water applied at a pressure of 60 lbs. per square inch; and to accomplish this they instal the necessary appliances. It is probable that the quenching of the coke by steam would be appreciated by all users of gas coke; and it would remove a very unpleasant process, as it now exists, through the application of water near the retort-house.

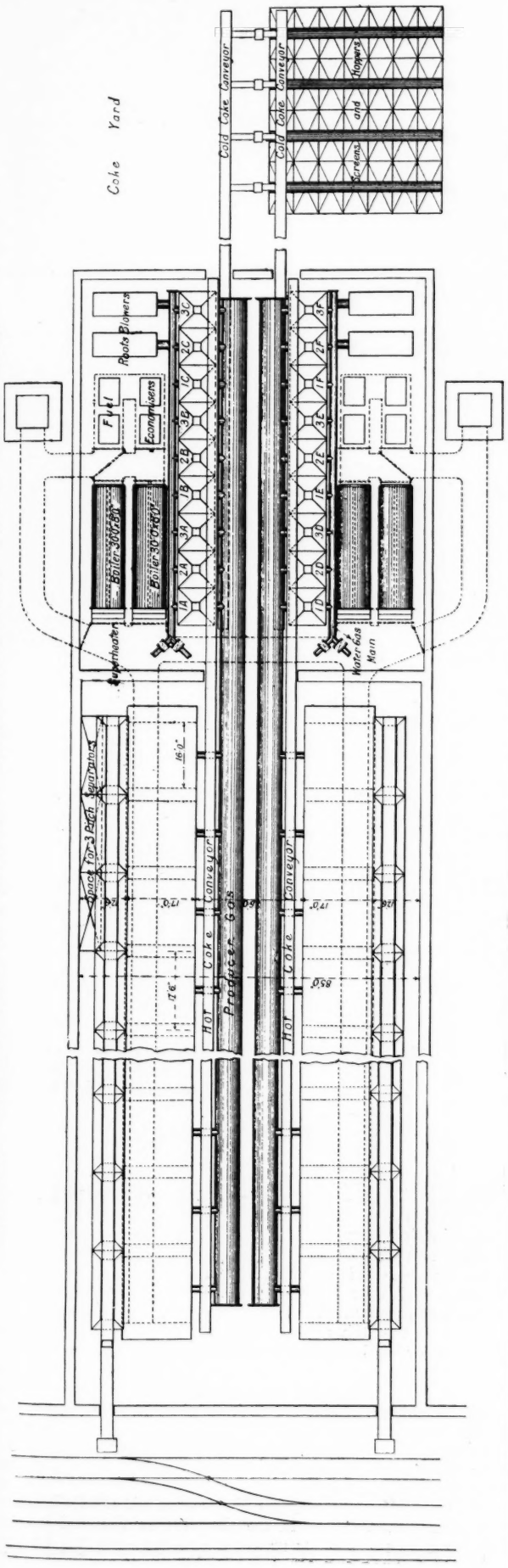
The erection of outside producers at the end of the retort-house, whether worked exactly as I have indicated or not, is a question that cannot wisely be ignored, because I believe it will lead to economies of construction and working that will be substantial. Thanks to the efforts of Mr. W. Foulis, M.Inst.C.E., and Mr. Charles Carpenter, M.Inst.C.E., one of the hindrances to the distribution of fuel gas to the different arches has been overcome, in each case in a very ingenious manner; in the first instance by externally water-cooled valves near the generators, and in the second by a seal of sand in the U-tube of each branch-pipe.

(*e*) In the sketch plan are shown arches each containing eighteen inclined retorts; but the number, or angle of axis, does not affect the general idea. The inclined system does, however, possess incidental advantages which are of importance. The method of charging and discharging makes it easy to combine two retorts into one, working the pair through one ascension-pipe; or nine out of the eighteen may have their pipes in front and the other nine at the rear—the front lot with ascension and the rear lot with decension pipes. By combining the two methods, it is possible to get 36 retorts, each 26 in. by 16 in., into an arch 16 feet between the piers. With recuperators to each arch, the cost is proportionately reduced if the number of retorts is increased, and by introducing producer gas on the front side, only the rear is left for the recuperator and main flue; while the width of the arches enables the waste-gas flues to be so large that a man can get in for repairs, and the air-flues alongside need only be as wide as is usual, and necessary to secure good contact with the walls of the gas-flues. By this design, too, the weight of the retorts may be kept from the recuperator, and each section may be removed or repaired separately.

The heat, being all generated at the front, where the coal is usually most difficult to carbonize, ascends in the front section, which is one-third of the width of the setting, and descends in the back section, which is consequently two-thirds of the width; it thence passes in a downward direction, as it gradually diminishes in temperature, through the recuperator, into the main flue.

The Lewes Water-Gas-in-Retort Process.

(*f*) If the further tests of carbonization of coal with the admission of water gas confirm the expectations raised by the trials at the Crystal Palace District Gas-Works, then it may be further expected that the tar produced in such a process will contain a lower percentage than usual of the more volatile constituents. Whatever that diminution may be, it is unlikely that it will detract from the value of the system; and it may be further considered in conjunction with the following facts: At the present time, we separate the tar from the crude coal gas by means of a rough-and-ready fractional condensation, which appears capable of some improvement. The tar condensed in the hydraulic main and the first portions of the foul main contains the



HALIFAX CORPORATION GAS-WORKS. DIAGRAM I.—SUGGESTED FORM OF RETORT-HOUSE.

pitch, comparatively free from the oils; and if kept separate while in its warm condition, it is in a forward state of preparation for ultimate distillation. If it be allowed to flow to the tar-tank and to mix with the light tars that separate from the subsequent condensation at lower temperatures, it becomes mixed with water, which is afterwards a difficulty to the distiller; and a separation of this and the oils from the pitch has to be effected by heat in a degree which would not be required if the tars were separated at the point named.

Seeing what a large proportion of tar—viz., two-thirds—is pitch, and that this is the material which costs most in carriage (often in the form of tar sent many miles to the distillery, and then brought back to the town of its origin as pitch), and seeing further that a very moderate application of heat, which is at hand near the retort-house, would suffice to complete the separation, does it not seem natural that the tar should run from the places named and then be separated (*a*) into pitch, and (*b*) into volatile matter? The water gas, at the high temperature at which it would issue from the generators, would effect this separation if brought into contact in a proper manner, and would take the volatile portions forward, leaving the pitch behind. If this *modus operandi* were found advantageous to the gas maker, it would also remove the chief difficulty of the tar distiller, and he would have a liquid tar capable of ready fractional distillation. Further, there does not appear any reason why the water gas destined to pass through the coal-gas retorts should not arrive there by way of the pitch vessels, carrying those hydrocarbon vapours to the place where they might be gasified more permanently than they had been before. This method of working would be an application of the counter-current principle, which, applied in a more complete manner, is seen in Mr. F. Lennard's continuous process for the distillation of tar.* A plant on Mr. Lennard's system is at present being erected at the Halifax Gas-Works.

After these indications of the chain of facts and reasoning that have led up to the conception, I may now briefly enunciate the sequence of operations involved.

1.—The coal is received into stores, and delivered thence mechanically, over screens or through breakers, to elevators and conveyors, into continuous hoppers over inclined retorts or in front of power stokers for horizontals, in a way that is now becoming general. If an automatic weighing-machine is placed at the head of the elevator, an account may be kept of the daily quantity of coal used, and if, in addition, an automatic weigher is provided for each charging-shoot, still further control may be attained.

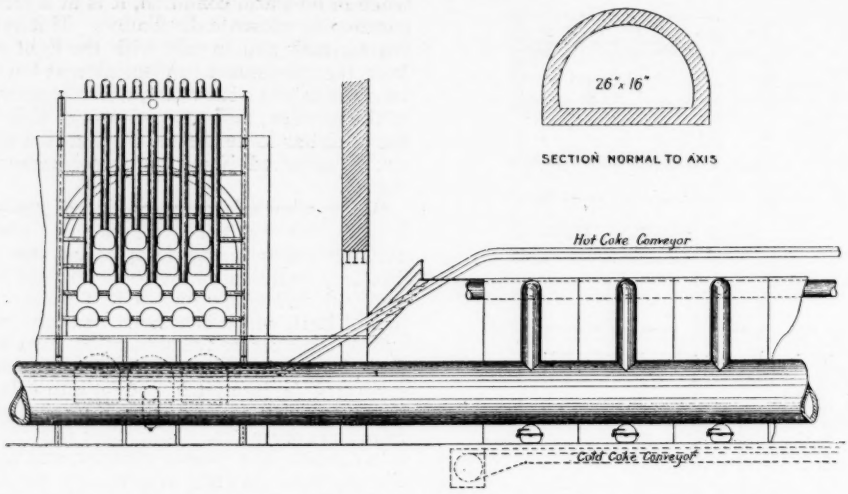
2.—The coal is carbonized in inclined retorts—say 26 in. by 16 in. in section and 20 feet long—placed eighteen in each arch, with one hydraulic main in front for nine 8-inch diameter ascension-pipes and one behind for nine 8-inch descension-pipes. This arrangement is shown on Diagrams Nos. 2 and 3; but horizontal retorts could be employed, and in many other ways the arrangements could be easily modified without departing from a sound and economical method of working. The sketch shows 32 settings of eighteen through retorts each, capable of producing 7 million cubic feet of coal gas, and with 3 million cubic feet of water gas—a total of 10 million cubic feet per 24 hours.

3.—All coke is discharged into a conveyor, taking it hot into a series of gas producers, and the generation in these vertical brick-lined vessels during "blows" of the producer gas required to heat the coal, and during "runs" of as much water gas as required. M. Gobbe, in the paper contributed to the Engineering Congress (Gas Section), proposed to make water gas only from the sensible heat of the coke, and that this should be used for heating the retorts.† This gas, however, appears to be worth collecting for distribution; while producer gas only would do all that is required for combustion in the retort-settings.

The course of the steam would be through the series of vessels, so that it would enter at the coldest of them and emerge at the hottest; and in this way the minimum of steam would be required and the lowest percentage of carbon dioxide and undecomposed steam allowed to pass forward. Similarly, the air would circulate in the series of vessels in the order of increase of temperature, and it could do so either under chimney draught or, probably better, from a blower. The coke probably need not be gasified to more

* See "JOURNAL," Vol. LXIV., p. 604. † *Ibid.*, Vol. LXXVIII., p. 778.

DIAGRAM II.—SUGGESTED FORM OF RETORT-HOUSE.



than 25 per cent.; thus avoiding the formation of clinker. It would emerge at the base of each vessel without excess of moisture and in a harder condition than usual, freed from a proportion of its sulphur, selenium, or arsenic by the action of the steam and air. If the mixture of coal gas and water gas is scrubbed with ammoniacal liquor, and that liquor is purified by heating to 200° Fahr., the gases liberated will contain, after passing through the sulphuric acid saturator, a considerable quantity of carbon dioxide and a small quantity of sulphuretted hydrogen with the steam. This waste gas or exhaust steam may be delivered, by means of a blower, into these coke vessels, in measured quantity, regulated by the speed of the machine.

The experience of the makers of Mond gas goes to show that the capacity of the generators to make gas is under instant control by means of the Roots blowers; and the pressure of gas in the delivery main shows at once the state of affairs. The producer gas would pass along a brick-lined main in front of the settings at the coke-vault level, and thence through a branch and sand seal into each arch, where the quantity would be regulated by a damper. The water gas would pass along a smaller main placed above the other, if required to work on the Crystal Palace Gas Company's system, or it could be passed direct into the foul main; or, better still, it could complete the separation of the pitch from the hydraulic main tar, and thence join the stream of coal gas.

4.—The mixed water gas and coal gas would pass through the same condensers, washers, and scrubbers supplied with purified ammoniacal liquor, which would leave in the mixture but a small percentage of sulphuretted hydrogen, carbon dioxide, or carbon bisulphide to be removed by lime and oxide in the dry purifiers.

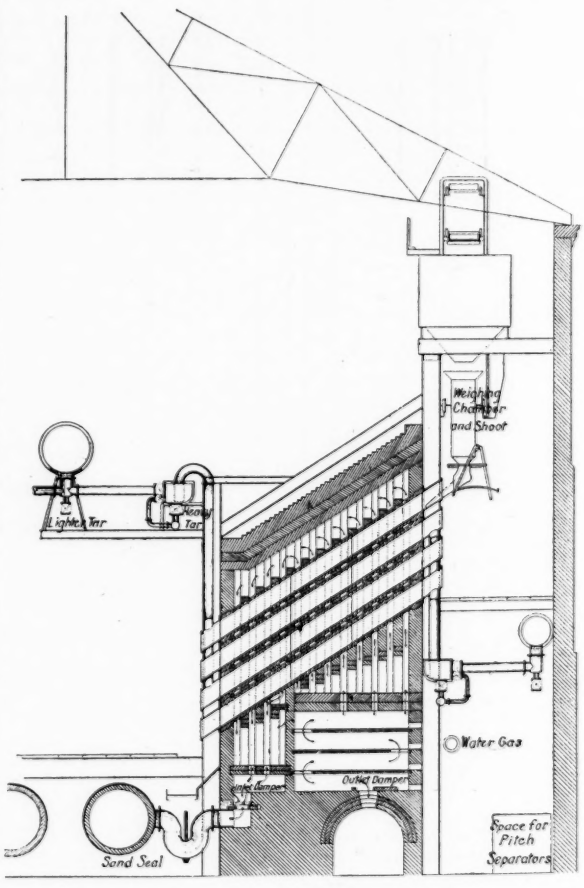
5.—The coke would be conveyed mechanically from the base of the generators to rotary screens placed over hoppers, and so divided into the various sizes to suit customers' requirements. (Shown on Diagram No. 1.)

6.—The main flue from the retort-settings would be continued so that the waste gases could be utilized in generating the steam required on the works, by passing through Lancashire boilers *en route* to the chimney. (Shown on Diagram No. 1.)

7.—The heavy tar from the hydraulic main would be passed into vessels for the separation of the pitch, the necessary heat being obtained from the sensible heat of the water gas, or, if preferred, from the waste heat of the retort settings. (Shown on Diagram Nos. 1 and 3.)

I fear I have left little time in which to refer to many of the other topics that crowd upon the gas engineer of the present day. But a few words must be said upon some of them that arise out of my recent experience. For several months during the past winter, at the Halifax Gas-Works, we were able to pass carburetted water gas through the same scrubber as that receiving coal gas, with several clearly defined advantages. The first was, of course, the great reduction in the percentage of carbon dioxide left to be removed by lime, and the second was the almost complete absence of oily matter at the purifiers. Out of these grew reduced back-pressure, a more perfect mingling of the coal gas and water gas, and a greater uniformity of

DIAGRAM III.—SUGGESTED FORM OF RETORT-HOUSE.



illuminating power as it reached the consumers. The deposit in flat-flame burners, which is so much greater when water gas is distributed, has been found to consist of iron, which, carried forward in the form of iron carbonyl, has been separated by the heat of the flame. It was observed that the more perfect the burner was, as a non-conductor of heat, and consequently in developing illuminating power, the more rapidly did the obstruction occur; the explanation being that these were just the conditions that provided the most perfect breaking up of the iron carbonyl into iron and carbon monoxide—the latter passing into the flame, and the former holding tenaciously to the steatite, whence it was best removed by a very fine saw.

The following table gives the amount of naphthalene present on several days in October last in the Halifax coal gas, as determined by means of the valuable test devised by Dr. Colman and Mr. J. F. Smith.

Date.	Temp. Deg. Fahr.	Bar. Inches.	Grains of $C_{10}H_8$ per 100 Cub. Ft., Uncorrected T. and B.	Grains of $C_{10}H_8$ per 100 Cub. Ft., Corrected T. and B.	Temp. at which Gas will be Saturated. Deg. Fahr.	Condensable Hydro-carbons. Per Cent. by Volume.	Unsaturated Hydro-carbons. Per Cent. by Volume.	CO. Per Cent.	H. Per Cent.	CH_4. Per Cent.	N. Per Cent.	H_2S. Per Cent.	CO_2. Per Cent.
1901.													
October 7 . .	58	29·20	7·900	8·120	39	1·3	4·3	7·3	48·55	33·56	4·99	Nil	Nil
,, 8 . .	62	29·10	7·900	8·195	39	1·2	4·6	6·9	46·2	35·60	5·5	Nil	Nil
,, 9 . .	56	29·60	4·740	4·760	34-35	1·0	4·4	..	..	..	..	..	..
,, 10 . .	60	29·70	6·320	6·390	36-37	1·1	4·5	..	..	..	..	..	..
,, 14 . .	54	29·50	2·820	2·830	31-32	1·0	4·3	..	..	..	..	..	..
,, 15 . .	56	29·15	3·950	4·030	33	..	..	..	..	..	..	..	..
,, 16 . .	54	28·95	1·317	1·344	29	..	..	..	..	..	..	..	..
,, 17 . .	54	28·85	2·370	2·420	30-31	..	..	..	..	..	..	..	..
,, 22 . .	48	29·15	3·290	3·290	32	..	..	..	..	..	..	..	..

The number of consumers is 25,000, and the total number of complaints of stoppages in service-pipes received that month was 92. It is quite possible to make carburetted water gas containing naphthalene; but by avoiding extreme temperatures we reduce it to a minimum, and consequently the works and distributing system have been almost free from this trouble. The month began and ended in entire absence of complaints; while the maximum was 17, on the 15th day.

It is important that bricks used in the carburettor and superheater should not contain more than 1 per cent. of iron, and also be low in lime and alkalies. The following table gives analyses of retorts, bricks, and fire-clay gathered from various parts of the country, and they show the great necessity of buying all such material with a guarantee as to composition. The absence of this is a continual source of danger; but happily the best firms are prepared to meet this reasonable request of the gas engineer.

An additional reason for this stipulation, in the case of carburetted water-gas plants, is to be found in the fact that the atmosphere round the bricks is constantly changing its character. This atmosphere is continually acting upon the iron in the bricks—which may exist in the two states of ferrous and ferric oxides. When air is in excess during the "blows," there is a tendency to oxidation; and when the "runs" are on, and carbon monoxide is present, de-oxidization is going on. Iron, when in the ferrous condition, increases fusibility, even more than when in the ferric; and this is an additional reason why it should be excluded as far as possible. The bricks in analysis No. 6 have proved quite superior for this purpose to Nos. 1 and 2 in respect of fusion; but to prevent cracking, they ought to have an increased percentage of alumina.

Analyses of Fire-Clay, Retorts, &c.

No. of Sample.	1.	2.	3.	4.	5.	6.
Components.	Fire-Brick.	Fire-Brick.	Retort Chips.	Fire-Brick.	Fire-Brick.	Silica Brick.
Silica	67·50	62·06	73·27	71·970	68·860	96·25
Alumina	22·39	27·65	21·62	24·200	23·990	1·00
Ferric oxide . . .	6·37	7·67	4·24	1·800	5·760	1·15
Oxide of manganese.	0·44	trace	trace	0·760	trace	nil
Lime	1·55	1·00	0 58	0·224	0·560	1·07
Magnesia	trace	trace	trace	0·096	0·161	..
Sodium oxide and potassium oxide .	1·30	1·62	0·29	0·950	0·669	0·53
Fire resistants . .	89·89	89·71	94·89	96·170	92·850	97·25
Fusible constituents	10·16	10·29	5·11	3·830	7·150	2·75
Total	100·05	100·00	100·00	100·000	100·000	100·00

No. 1.—Brick taken from carburetted water-gas superheater—bad.
No. 2.—Brick taken from carburetted water-gas carburettor—bad.
No. 3—Retort made in the Stourbridge district—not satisfactory in iron.
No. 4 - A fire-brick of satisfactory quality.
No 5.—A fire-brick from a firm of retort makers - not satisfactory.
No. 6.—Proved quite satisfactory in the carburettor and superheater of water-gas plant in resisting fusion, but inclined to crack if afterwards moved.

The laudable endeavour to reduce severe manual labour by machinery is extending in most large and medium-sized works; and this advance brings with it the question of repairs and avoidance of breakdowns. Many reasons point to the desirability of each gas-works being so equipped with work-shops and machine tools that this difficulty is reduced as much as possible; and in this matter my experience suggests that every endeavour and consideration should be given towards getting the best of these tools. I cannot enter into details; but I would suggest as a subject for an interesting and helpful paper "The Place of Mechanical Engineering in Gas-Works." There is, in the construction and steam consumption of air compressors, pumps, engines, &c., and the equipment of boilers, machine tools, and other mechanical appliances, abundant scope for discussion, and I believe for improvement, in gas-works practice.

At the annual meeting of the Institution in 1895, I had the honour of reading a paper upon "Purified Ammoniacal Liquor and its Use in Gas Purification." A lengthened experience of the process described in that paper enables me to confirm the results then stated. The saving in wages, in lime, and in the cost of removal of spent lime, have been unmistakable; and the value of the system is now placed beyond doubt.

In an appendix to this address are set forth a series of tests of incandescent burners, which show that, by simply governing the supply of gas with exactitude, from 60 to 70 candles per cubic foot are obtained, using an ordinary Kern burner, or another one of quite simple construction.* By heating the air and gas by means of the products of combustion, a further increased duty can be secured—86 candles per cubic foot being obtained by a simple appliance; so that it is not unreasonable to regard 100 candles as possible of attainment. While I must refer you to this appendix to see the full significance of the tests, I must give prominence to several characteristics that have been manifest, as bearing upon the way in which luminosity is developed. While it has been demonstrated that an exact control over the quantity of gas is essential, it has also been found that apparently similar conditions have in some cases been productive of distinctly lower results.

The form of governor—whether it is a diaphragm or a disc, whether it has an adjusting screw on the disc or below it—has an influence on the results. The presence of currents of cold air impinging on the mantle, the effect of hot gas or hot air supplied to the mixing bulb, or of warm air to the exterior of the mantle, all have a distinct effect on luminosity; and, as a consequence, with a good street-lantern, in which the air is admitted at the top, well protected from draughts, a higher result is obtained than with an open atmosphere. Where a chimney is used to increase the inflow of gas and air into the mixing bulb, mischief may be done by at the same time increasing the air to the outside of the mantle. Again, the effect of the chimney may be modified and usually improved by placing upon it a baffle-plate.

In the case of the Lucas light, with 18-candle gas, the No. 26 jet (0·1038-inch diameter) was found to give the best results—an average of 51·47 candles per cubic foot; while when a fresh governor was introduced, that figure fell to 33·96, and when a five-holed jet (each hole 0·0554-inch diameter) was substituted for the one hole (No. 26), the results fell to 32·42 candles per cubic foot. The Podmore and Thomas recuperative lamp was tested with a maximum illuminating power of 49 candles per cubic foot; but the tests No. — in Appendix B show, with a home-made lamp, using both hot gas and hot air, 86 candles per cubic foot. The figures of the tests are given there at length, so as to be available for all those makers or users who are striving to improve the apparatus. The table (p. 1180) gives a few of the principal results obtained, and shows the importance of the several influences already enumerated.

It appears that the luminosity from a mantle does not rise or fall in small gradations, but proceeds by steps, according to the quantity of gas used and its proportion of air. In cases where a long chimney has been employed, it has been found that "tapping" the same, so as to cause a little vibration, has increased the illuminating power by one of these steps, as though the vibrations inside the mantle required but a slight increase in their intensity to make them alter their wave length or their frequency to attain the next rank in the scale of light emission. There have been other phenomena of a similar kind, which appeared to be due to the slight oscillation of the disc inside the

*This appendix has not so far been completed, but is promised by Mr. Holgate for a subsequent issue.—Ed. J. G. L.

No. of Test.	How Fitted.	Burner Used.	Mantle Used.	Glass Protector Used.	Governor Used.	Maximum Efficiency.				Average Efficiency.
						Pressure at Jet.	Cubic Feet per Hour.	Illuminating Power.		
								Total.	Per Cubic Foot.	Per Cubic Foot.
						Inches.		Candles.	Candles.	Candles.
	NON-RECUPERATIVE BURNERS IN LANTERN.									
1	With anti-vibrator air admission	Simplex A.	Eagle	Yes	A.	0·80	2·40	175	72·9	66·68
2	Without ,, ,, ,,	,,	,,	,,	,,	1·00	2·70	170	63·0	58·88
	Difference	..	..	..	..	..	..	..	9·9	7·80
3	Four in 33-inch hexagon lantern	No. 4 Kern	Welsbach	No	B.	1·20	13·90	970	69·5	63·49
4	Three ,, ,, ,,	,,	,,	,,	,,	1·20	8·20	560	68·3	53·07
5	Two ,, ,, ,,	,,	,,	,,	,,	1·20	6·40	442	69·0	62·47
6	In 14-inch square lantern	Simplex A.	Welsbach C	Yes	,,	0·50	2·10	119	56·8	49·13
7	,, ,, ,, ,,	,,	,,	,,	B. & C.	0·50	2·00	123	61·5	45·55
8	,, ,, ,, ,,	,,	,,	,,	A. & C.	0·50	2·40	155	64·6	63·33
9	,, ,, ,, ,,	,,	,,	No	A. & C.	0·60	2·40	155	64·6	63·40
10	,, ,, ,, ,,	,,	,,	Yes	A. & C.	0·54	2·27	161	70·9	68·73
	RECUPERATIVE BURNERS IN LANTERN.									
11	With ⅛-inch diameter mixing-tube; hot air and cold gas	Simplex A.	Eagle	Yes	A. & C.	1·50	2·92	230	78·8	68·83
12	With ⅛-inch diameter mixing-tube; hot air and hot gas	,,	,,	,,	A.	1·05	2·42	209	86·4	81·63
13	With usual cones; hot air and hot gas	,,	,,	,,	A.	2·85	4·13	340	82·3	69·20
	Difference between 1st and 2nd	..	..	..	..	..	..	..	7·6	12·80
	,, ,, 2nd and 3rd	..	..	..	..	..	..	..	4·1	12·43
	RECUPERATIVE BURNERS NOT IN LANTERN.									
14	As diagram No. 4, but without anti-vibrator	Simplex A.	Welsbach C	Yes	None	1·00	3·47	147	42·4	38·30
15		,,	,,	No	,,	1·00	3·60	109	30·3	29·20
	Difference	..	..	..	..	..	..	..	12·1	9·10
16	As diagram No. 4, but without anti-vibrator	Simplex A.	Welsbach No. 4	Yes	B.	0·80	3·35	99	29·5	27·00
17		,,	Welsbach C	No	A. & C.	0·54	2·52	165	65·5	62·91
18		No. 4 Kern	Welsbach No. 4	Yes	None	1·00	3·70	134	36·3	32·60
19		,,	,,	No	,,	1·00	3·72	152	40·9	34·86
	Difference	..	..	..	..	..	..	..	4·6	2·26
20		No. 4 Kern	Welsbach No. 4	Yes	B.	0·80	3·27	91	27·7	21·80
21		,,	,,	No	A.	0·54	2·43	169	69·7	59·50

Notes.—Governors: A. Peebles', with adjusting screw under disc. B. Peebles', with adjusting screw on disc. C. Sugg's disc for 5 cubic feet per hour. Gas used tested 18 candles in Referees' table photometer.

governor, which favoured the increased vibrations of the gas and air within the burner and mantle. When supplying air under pressure from a Roots blower, it was noticed that the issue of the same at the burner was accompanied by a musical sound; and the higher the note the greater the efficiency under these particular conditions. That note, however, ceased as soon as the air supply was divided into two streams, although originating and terminating in the same places as before. In the cases of high efficiency, which include the Lucas lamp among others, there was a subdued rumble, which varied slightly near the point of maximum efficiency per cubic foot of gas.

The cause of luminosity in the incandescent mantle has not, I believe, yet been explained; but certain experiments made in Germany and in America, and recently reported in the technical press, point to the inadequacy of the theories hitherto propounded—that chemical action is the cause. The Halifax experiments appear to indicate that it is rather due to the synchronism in the vibrations of the particles of the mantle set up by the rapid movement of the gases during combustion; suitable chemical composition being necessary in the mantle (in order to obtain the refractory material, and that material in the proper physical condition) to respond most readily to the rapid vibrations. It is desirable that the incandescing material should be as widely attainable as possible; and if gas authorities can aid in elucidating the doubt as to the chemical composition required for the best luminosity, and by investigation add to the number of suitable components, then a valuable work will have been performed. The interval between the present time and the termination of the existing patents for Welsbach mantles might very profitably be spent in this search; and if commercial considerations favoured such a course, the suppliers of gas could supply the mantles.

Another important question requires to be cleared up: Is the illuminating effect greatest when (*a*) a small quantity of gases (gas and air in best proportion) unite to produce a high temperature with a moderate evolution of heat; or (*b*) when a larger quantity of gases (gas and air in best proportion) unite to produce a lower temperature with a larger evolution of heat? From my experiments, I infer that the former of these hypotheses is likely to prove the correct one. Be this as it may, we are now in a position to dispense with costly enrichment, and the consumer may obtain light from gas at a cost much below that of any competitor.

What is the precise quality of gas measured by the calorimeter, and its corresponding photometric value, that it is desirable to distribute is not quite clear; but a contribution from Mr. W. W. Woodward, the Engineer of the Salford Gas-Works, will help towards its elucidation. By his kindness, I am permitted to give you figures showing the relative value in a Welsbach "C" burner of the rich gas usually supplied at Salford and of a low-grade gas specially made for this comparison. The high-grade gas, when burnt in the 15-hole argand, gave 3·84 candles per cubic foot; while the low-grade gas, made from old stacked slack carbonized at a high temperature, tested in the same burner, gave 1·31 candles per cubic foot. When these two grades of gas were burnt in a "C" burner, they gave 15·95 and 13·45 candles per cubic foot respectively.

The details of the tests are given in Appendix A, and will be valuable for reference; but knowing, as we do, that the adjustment of the air supply to the quality and quantity of gas used is of supreme importance, we cannot say, from these figures alone, what is the relative value of high and low grade gas when each is used to the best advantage. What, however, appears to be evident is that it is easier to get through the ordinary incandescent burner the requisite quantity of air with low-grade than with the high-grade gas. Nearly all the modern developments of incandescent burners and lanterns hinge upon this one requirement—the drawing in by chimney draught, or compelling by gas or air under pressure, the inflow with the gas of a sufficiently large proportion of air. It is the long-standing difficulty of getting high-grade gas efficiently consumed repeated under the new *régime*.

Thanks to the exchange of international courtesies during recent years between the representatives of gas manufacture in Great Britain and those of the leading nations of the Continent, the horizon has been widened, and a feeling of common interest has been engendered, from which we may hope

mutual advancement will arise. The technical literature of our *confrères* bears witness that they still look to this country, as they did in past days, for help, and may be guidance, in the large questions that from time to time confront us; while we, in turn, take a similar interest in the many valuable contributions they are making to the general progress. I hope that, in this spirit of mutual helpfulness, we shall at home soon be able to combine our forces, so that with a united Society, aided and guided by the lessons of the past, an era of still greater progress may be inaugurated.

We are met here to discuss questions (raised by a series of papers) that are of the greatest importance, and the reports of which will be awaited with interest by our professional brethren everywhere. In so doing, we are contributing to the spread of technical education in its highest form, in the uniting of science with the facts of daily experience gained in an important part of the chemical and engineering world. If we have in the past in any way fallen short of the noble traditions of British engineering, we can still point to many embodiments of high aspiration and worthy achievement; and there is yet time and opportunity in which we may similarly serve our day and generation, handing forward an industry increasingly fruitful in its deeds for the public weal.

Appendix A.

Tests Made with High-Grade and Low-Grade Gas.

Series No. 1.

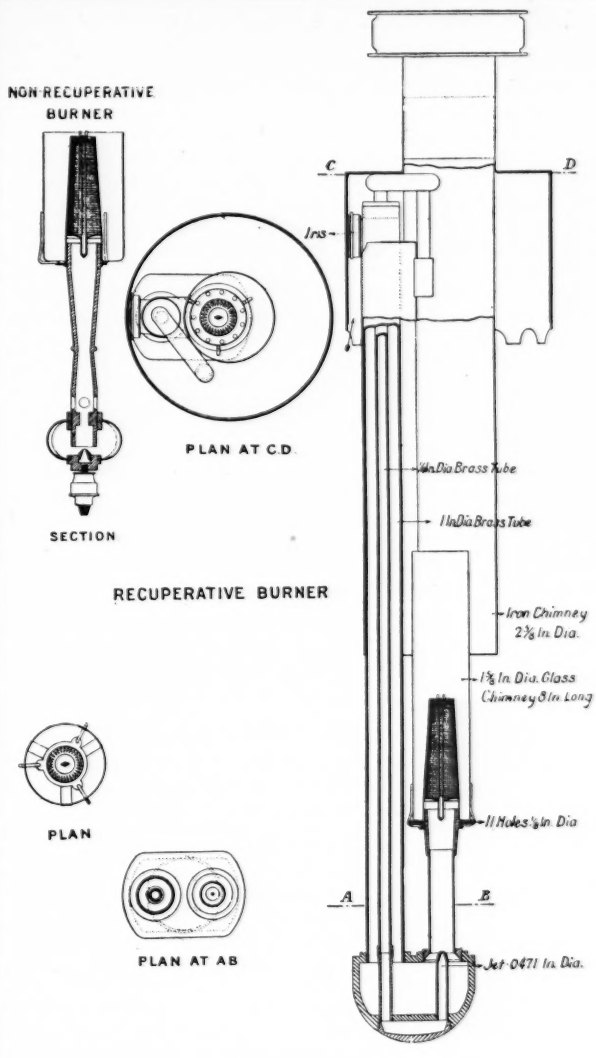
The high-grade gas used was the gas as supplied from day to day from the Regent Road works. The low-grade gas used was made from old stacked slack, using high heats. A fresh mantle was used, in the tests of incandescent burners, for each pair of tests.

High-Grade Gas.			Low-Grade Gas.		
Number of Test.	Salford Standard 15-Hole Argand Burner, Consumption 5 Cub. Ft. per Hour.	Welsbach "C" Burner, Consumption 3·5 Cub. Ft. per Hour.	Number of Test.	Salford Standard 15-Hole Argand Burner, Consumption 5 Cub. Ft. per Hour.	Welsbach "C" Burner, Consumption 3·5 Cub. Ft. per Hour.
	Candles.	Candles.		Candles.	Candles.
1	19 40	58	1	7·18	50
2	19·60	56	2	7·41	52
3	18·96	60	3	7·44	56
4	19·22	56	4	6·87	50
5	20·15	52	5	6·86	40
6	19·25	58	6	6·80	44
7	19·04	58	7	5·51	47
8	18·68	56	8	5·69	46
9	19 24	54	9	6·70	48
10	18·72	56	10	6 62	48
11	19·08	50	11	5·69	41
12	18 97	56	12	5·80	43
Average .	19·19	55·83	Average .	6·55	47·08
Comparative value, the argand being taken at 100	100·00	Corrected to a consumption of 5 c. ft. per hour. 79·75 415·58	Comparative value, the argand being taken at 100	100·00	Corrected to a consumption of 5 c. ft. per hour. 67·25 1026·72

Series No. 2.

[Conditions as in Series No. 3.]

High-Grade Gas.			Low-Grade Gas.		
Number of Test.	Salford Standard 15-hole Argand Burner, Consumption 3 Cub. Ft. per hour.	Welsbach "C" Burner, Consumption 3·5 Cub. Ft. per Hour.	Number of Test.	Salford Standard 15-hole Argand Burner, Consumption 5 Cub. Ft. per Hour.	Welsbach "C" Burner, Consumption 3·5 Cub. Ft. per Hour.
	Candles.	Candles.		Candles.	Candles.
1	19·48	62	1	9·46	57·50
2	18·78	59	2	8·86	54·00
3	18·96	54	3	9·06	52·00
Average . .	19·07	58·33	Average . .	9·13	54·50
Comparative value, the argand being taken at 100	100·00	Corrected to a consumption of 5 c. ft. per hour. 83·33 436·97	Comparative value, the argand being taken at 100	100·00	Corrected to a consumption of 5 c. ft. per hour. 77·86 852·79



Series No. 3.

The high-grade gas used was the gas as supplied from day to day from the Regent Road works. The low-grade gas used was made from the old stacked slack, using high heats, with the addition of a quantity of 19-candle gas. A fresh mantle was used, in the tests of incandescent burners, for each pair of tests.

High-Grade Gas.			Low-Grade Gas.		
Number of Tests.	Salford Standard 15-hole Argand Burner, Consumption 5 Cub. Ft. per Hour.	Welsbach "C" Burner, Consumption 3·5 Cub. Ft. per Hour.	Number of Tests.	Salford Standard 15-hole Argand Burner, Consumption 5 Cub. Ft. per Hour.	Welsbach "C" Burner, Consumption 3·5 Cub. Ft. per Hour.
	Candles.	Candles.		Candles.	Candles.
1	19·44	54	1	14·72	58
2	19·16	56	2	14·90	58
3	19·20	48	3	14·48	52
4	18·48	54	4	15·02	52
5	18·62	52	5	15·40	53
6	18·50	56	6	15·52	56
7	18·31	52	7	15·40	54
8	18·72	56	8	15·17	52
9	18·78	56	9	15·26	58
10	18·60	60	10	15·03	57
11	19·42	52	11	15·23	54
12	18·98	55	12	15·02	56
Average .	18·85	54·25	Average .	15·09	55
Comparative value, the argand being taken at 100	100·00	Corrected to a consumption of 5 c. ft. per hour. 78·50 411·14	Comparative value, the argand being taken at 100	100·00	Corrected to a consumption of 5 c. ft. per hour. 77·57 520·67

Mr. H. E. Jones (London) moved that the best thanks of the meeting be given to the President for his address. They

had all, he said, listened to it with great interest and attention, and must be very thankful for it. He could only say for himself that he had never listened to one which was more suggestive, which gave evidence of more thoughtful preparation, or was more thorough, practical, or scientific. Above all, it showed the useful lines on which they might themselves pursue their daily work. The address revealed such careful study and exhaustive research that it rather staggered an unfortunate contributor of a paper like himself. But it was instructive to find that gentlemen who were not pulled this way and that way as he was could devote to these subjects an amount of time which, he must say, he found impossible amid the hard work of a professional engineer. Many points touched upon by the President had occurred to him (Mr. Jones) lately in connection with various investigations in which he was concerned; and he was glad to find that their ideas ran very harmoniously. He could only say, in case the amalgamation were successful, that their President would do credit to both Institutions.

Mr. J. L. Chapman (Harrow), seconding the motion, said, as a representative of small gas-works, he felt they had never had a better address from a President since the Institution was formed. It was most interesting from beginning to end. They would have thought it long if it had not been so interesting. But it really seemed quite short; and he was sure it would help them very much in their daily work.

The motion was carried unanimously.

Papers Read.

The reading of papers was then commenced. They were taken in the following order:—

Wednesday.—(1) "Heat Efficiencies of Gas, Oil, and Steam Engines." By (the late) Bryan Donkin. (2) "On the Illuminating Power of the Gas of the Future." By H. E. Jones, M.Inst.C.E.

Thursday.—(3) "A Suggestion for the Unification of the Methods of Stating the Items Comprising the Carbonizing Costs in Gas-Works." By W. R. Herring, M.Inst.C.E. (4) "Coal Gas Condensation—A Theory." By A. F. Browne. (5) "The Solubility of Naphthalene." By J. F. Smith, of Halifax. (6) "A Talk on the Development of the Gasholder." By George Livesey.

Some of these, with the discussions thereon, will be found in another part of the "Journal;" and the remainder will be given next week.

The Position of Secretaries in the Proposed Amalgamation.

On the resumption of the proceedings on Thursday,

The President said the Hon. Secretary wished to make a further statement with regard to the amalgamation.

Mr. Helps said that since the previous day he had been reviewing in his mind the existing position of affairs, and had also had an opportunity of talking with an eminent official of the Gas Institute thereon; and the result was that he could not help coming to the conclusion that what they did on the previous day was not entirely satisfactory. He was not going to suggest for a moment that any alteration should be made in the resolution as passed—it should stand exactly as it was. He should like, however, to remind members that, in the few remarks he made in opening the discussion, he said it appeared to him absolutely necessary that whatever they did should be final; that they should be in a position to say to the Gas Institute exactly what their intentions were, and to what extent they were inclined to meet them on this question of the admission of members. He also, in giving an account of the joint conference some time ago, told them that there were three suggestions made. The first one he need not now mention; the second was one which dealt with the admission of those members who had been gas engineers, but who no longer were so—having possibly gone into trade; and the third was with regard to the admission of secretaries. He thought it was necessary to give some answer on the two latter points beyond what was already given in the resolution. Probably the members would say that the first—with regard to the admission of those members who were no longer gas engineers—was covered by the resolution, and that they would have to stand on the terms of that resolution. But there was still another point, with regard to the secretaries. He did not think that in this matter there was any serious principle involved. It was true that, under the proposed rules, in the new association secretaries would not be eligible. It must also be remembered, however, that there were secretaries (acting solely as such) among the members of the Gas Institute, and he thought even among their own members; and it did seem to him that it would be a little hard for them, from no fault of their own, to be absolutely placed outside. He should like the meeting to decide that day, so that the members of the Institute could know exactly their intentions—whether they intended, first, that those who were no longer engineers should be included and dealt with under the resolution already passed; and, secondly, whether they were prepared to alter the rule, without mentioning any names, to the effect that any member of the Institute or the Institution acting solely as secretary might be allowed to enter the new association, either as a member or as an associate member. He thought this should be settled at once, so that there should be no necessity for the Institute to come back and ask further questions, but would know, once for all, the extent to which the Institution were prepared to go. Then any further discussion or negotiation, except on minor details, would be necessary.

Mr. H. E. Jones said that, having moved the resolution on the previous day, it might become him to say how the matter appeared to him. He thought the gas engineer who had stepped down, as he called it, must take his chance of being elected to the honorary class. Personally, he would rather have the manufacturer who had distinguished himself in the service of the gas industry than the engineer who had stepped down from gas engineering to trade. But there might be such classes, and they would, in his view, be eligible for election to the honorary class. With regard to secretaries, who were only secretaries, he thought that also very simple. It was necessary, in a small works, that the manager should discharge secretarial duties, and he would essentially be a full member; but the secretary who was purely a secretary, and did nothing but clerical duties, might be an associate member. He thought that their ranks ought to include all. He should like to see the idea carried out which Mr. Lacey had mentioned to him, though he would not bring it forward, that there should be an association of all who were interested generally in gas—not, of course, to join the Institution of Gas Engineers, because they were either gas engineers or nothing, but another association of all parties, to which he, as a gas engineer, would be quite willing to belong. But, apart from that, the question was what was to be done with the engineer who had gone into trade. If he was a good engineer and a distinguished trader, they could elect him into the honorary class; if not, they could let him go. The secretary who was also an engineer or a manager would be a full member; while the secretary who was not an engineer at all might be an associate member. He should like to see this class include auditors like their old friend Mr. Magnus Ohren, whom he regretted not to see present that day.

The President suggested that Mr. Jones should move a resolution to the effect suggested.

Mr. Jones accordingly proposed it in the following form: "That existing members of both Societies who, having ceased to hold positions as engineers or managers of gas undertakings, would be ineligible under the proposed new rules, be dealt with under the terms of the resolution passed on April 30; and that existing members of both Societies acting solely in the capacity of secretaries of gas undertakings be eligible for election as associate members of the proposed new association." He did this with the understanding that this was the fullest extent to which the Institution would go. He had great sympathy with Mr. Harman on the previous day. He did not wish to go on, meeting after meeting, flogging a dead horse.

Mr. Chapman said he had great pleasure in seconding the resolution.

Mr. Harman said the whole proceeding with respect to amalgamation seemed to him to be quite irregular. The first item on the *agenda* for the previous day's meeting was amalgamation; and a number of members made a special point to be present, so that they might have an opportunity of hearing the *pros* and *cons* of the case. But many of them were not there now. He thought it rather irregular to spring this matter upon them again on the second day. It would be much better to leave it as it was.

The President then put the resolution, which was carried *nem. con.*

Sympathy with Mr. and Mrs. Chester.

The President said he would suggest that the meeting should send to Mr. and Mrs. Chester and the family a message of sympathy to them in their severe affliction. They all knew Mr. Chester's worth, and they recently had the pleasure of hearing a paper by him at the autumn meeting of the Institution in Glasgow. It was within the knowledge of most present that the report from the specialist who had been consulted with regard to Mr. Chester's health was not of a very encouraging character; but it might be cheering to him and his family if a sympathetic message were sent. He would therefore move that this be done.

Mr. Livesey said he had much pleasure in seconding the resolution. Their sympathy must go out very strongly to Mr. Chester and to Mrs. Chester and the family.

The resolution was carried unanimously.

Election of Scrutineers.

The President moved the re-election of Messrs. Guyatt, Iago, and Price, as Scrutineers, with thanks to them for their past services.

Mr. Helps seconded the motion, which was carried.

Votes of Thanks.

The President proposed a vote of thanks to the President and Council of the Institution of Civil Engineers for their kindness in granting the use of their rooms for the purposes of the meeting.

The motion was seconded by Mr. Harman, and carried unanimously.

The President next proposed a vote of thanks to the authors of papers; saying there was every reason to congratulate them, not only on the matter they had brought forward, but also on the manner in which they had presented it.

Mr. Ashworth seconded the motion, which was carried unanimously.

The President then moved a vote of thanks to Mr. Magnus Ohren, the Honorary Auditor. They were sorry not to have had his presence at the meeting; but they were very pleased that he was able to continue his services.

Mr. Chapman seconded the motion, and it was carried unanimously.

Mr. Charles Hunt moved a vote of thanks to the Council for their management of the affairs of the Institution during the past year. The success of the meetings depended, he said, on the work which the Council did during the year; and this had not been lessened, but rather increased.

Mr. R. O. Paterson, in seconding the motion, said they were all under a deep sense of obligation to the Council; and he only expressed the feelings of the members at large in saying that he hoped their efforts in the past year with reference to amalgamation would be crowned with success.

The motion having been carried unanimously,

Mr. Herring briefly acknowledged it.

Mr. S. Glover moved that the best thanks of the meeting be given to the President for his conduct in the chair.

Mr. C. F. Botley seconded the motion, which was carried unanimously.

The President, in thanking the members for the hearty manner in which they had received the proposition, said he should feel rewarded for anything he could do if at the end of the year he was able to feel that the interests of the Institution had not suffered at his hands. He would take the opportunity of proposing a hearty vote of thanks to the Honorary Secretary, Mr. Helps, the value of whose services could already be appreciated, though he had only recently been appointed.

Mr. W. King (Liverpool) said he had great pleasure in seconding the motion, not only on account of Mr. Helps's services to the Institution as Honorary Secretary, but also for those he rendered in connection with the Congress in Glasgow last September.

The motion was carried unanimously.

Mr. Helps said he sincerely appreciated the honour done him, which he could only assume proceeded on the principle that gratitude was a lively sense of favours to come.

The President then proposed a vote of thanks to the Secretary (Mr. Cole), which was seconded by Mr. Helps, and carried unanimously.

Mr. Cole, in responding, said this appreciation of his services would be a great encouragement to him in carrying on his work.

The proceedings then terminated.

PAPERS READ.

STEAM, GAS, AND OIL ENGINES.

COST OF FUEL PER BRAKE HORSE POWER PER HOUR AND THEIR HEAT EFFICIENCIES.

By (the late) Bryan Donkin.

It is very desirable to fix upon some correct standard of comparison, from a heat point of view, for oil, gas, and steam engines in daily use. Their respective heat efficiencies from reliable tests are pretty well known, as is also the cost of the liquid, gaseous, and solid fuels. For power, the best standard is the brake horse power now adopted by so many engineering societies and institutions in Europe and America. The friction of the engine alone, or the mechanical efficiency, should also be known, and a given percentage guaranteed by the makers. But this is not here considered.

To compare the economy of these very different types of heat motors, it is clearly inadmissible to contrast pounds of coal or coke with pounds of oil or gas per unit of power, as their heating values and cost vary much. The thermal efficiency per brake horse power is now largely used in standard books and tests by the best authorities and engineers in the chief industrial states; and it is probably the most accurate standard to adopt. Such efficiency is the ratio or percentage of heat actually used in a test to that theoretically required per brake horse power per hour, whether for steam, gas, or oil. To make a real commercial comparison, however, the money question must come in; or the price paid in a given town, for the very different fuels, whether coal, oil, or gas, must be stated. When this is known, the cost per unit of power can be calculated.

A millowner generally knows little about heat efficiencies, but more about the cost of the coal or gas he will have to pay for in his locality, assuming that it is a question of putting up one or other of the above types of motors. The author does not propose to go into the question of the first cost of these engines, or their repairs, depreciation, or rates and taxes and attendants—often heavy items—but will only endeavour to answer the following question: In a given town, taking certain practical thermal efficiencies based on tests for a gas, oil, or steam engine, and for the generator or boiler certain prices of fuels, what is the cost of the fuel only per brake horse power per hour?

The cost of the several fuels, delivered, varies much in different localities. I have more often taken London, but in some cases the Midlands. I have added their heating values per pound based on calorimetric tests. The cost of lighting gas and oil in London is well known. But it varies a good deal in different parts of England and Scotland. Steam, gas, and oil engines are made for different powers, and the approximate limits of horse power, from which the calculation and heat efficiencies are made, are added.

The thermal efficiencies of these engines vary much per brake horse power, according to the type, size, make, and other circumstances. I have therefore taken several—viz., a high, an ordinary, and a low efficiency—to suit various cases, and all are based on tests. The cost of fuel for any of these motors can, of course, be worked out per brake horse power per hour in the usual way, when the price and quantity of coal gas or oil per horse power are known; but this calculation does not separate the steam-engine from the steam-boiler, or the gas-engine from the gas-generator, and ignores their relative economy. The thermal efficiencies of each should be separately known to judge how good or how bad each motor is, apart from its boiler or generator, &c. A fairly constant load is assumed in all cases. The cost of fuel per brake horse power hour can be calculated for any other efficiencies or for any other prices of fuels than those given in the table, and in a similar way.

Table I., for Steam Engines and Boilers.—Three for London and one in the Midland counties, where coal is much cheaper. In the first case, 18 per cent. thermal efficiency per brake horse power has been taken as about a maximum for the highest class of compound or triple engines, condensing and steam-jacketed, of modern make and with high steam pressure; 8 per cent. for a low-class engine, but often met with; 13 per cent. as an ordinary average case. These are for the engine alone. For the steam-boilers, an efficiency must be fixed upon based on tests. These vary much, and more from the way they are worked—whether forced or not—than from the type in use. A maximum is about 80 per cent.,

and a minimum about 50 per cent. A more usual figure of 65 per cent. has been taken for current practice, and is easily obtained. It is rather a low efficiency, but boilers are too often carelessly treated. In the author's book on "The Heat Efficiency of Steam-Boilers," many hundred tests of boilers are given, with their thermal efficiency. Column 4 gives the heating value (lower) per pound of coal based on calorimetric tests, and column 5 the present approximate market price of coal delivered in a boiler-house in London and in the Midland counties. Column 6 is the cost per pound of coal deducted from column 5. Column 7 is the number of thermal units in the coal purchased for 1d., calculated from columns 4 and 5. Column 8 is the theoretical quantity of heat required per brake horse power per hour; 33,000 foot-pounds divided by 778 foot-pounds (= 1 T.U.) gives 42·4 T.U. per minute, or the Joule equivalent for 1-horse power; and this multiplied by 60 = 2544 T.U. per hour. Column 9 is the additional quantity of heat actually required per brake horse power per hour for the different efficiencies of the steam-engine alone, given in column 2. Taking the first case, 18 per cent. of 14,130 = 2544 T.U. Column 10 is a still further quantity of heat per brake horse power per hour to make up for the boiler losses, or 65 per cent. of 21,730 = 14,130. Column 11 gives the cost of the fuel only per brake horse power per hour, calculated as follows: Column 7 gives the number of thermal units for 1d., and column 10 the total number of thermal units actually required for the 18 to the 65 per cent. of engine and boiler respectively for the first case; so that dividing 21,730 by 96,500 = 0·225d., or the cost per brake horse-power-hour, or rather less than ¼d.

Table II., for Producer Gas and Gas-Engines.—Column 2 gives the efficiencies per brake horse power for the gas-engines only from tests, from a maximum of 24 per cent. to about a minimum of 14 per cent. Column 3 gives the efficiency of the producer only; 65 per cent. is a usual figure for the Dowson and other types. The other columns are worked out in a similar way to those of Table I., so that explanations are hardly necessary. The cost of fuel per brake horse power per hour works out in different cases from 0·137d. to 0·250d.

Table III., for Lighting Gas and Gas-Engines.—This gas is generally used for rather small engines only, as it is comparatively expensive. The heat efficiency of these engines varies from about 25 to 14 per cent. per brake horse power—18 per cent. being very usual. The present London prices of gas per 1000 cubic feet have been taken—viz., 2s. 3d. and 3s.; the former being for the South Metropolitan Company, and the latter is the Gaslight and Coke Company's price. The cost of the gas per brake horse-power-hour comes out rather high—from 0·458d. to 0·847d. for London.

Table IV., for Oil-Engines.—As in Table III., we have no boiler or generator. The thermal efficiencies per brake horse power (based on tests) range from 27 to 14 per cent. Suitable motor oil has been taken at a price of 6d. per gallon, delivered in London, which, at ·80 specific gravity, comes out at ¾d. per pound. The cost per brake horse power per hour is also rather high—from 0·372d. to 0·717d.

Table V., for Mond Gas and Gas-Engines.—To make a comparison, we have supposed rather a small Mond producer at work, and in London, without a recovery plant. The heat efficiency for the gas-engine per brake horse power ranges from 26 to 22 per cent. For the generator, 70 per cent. has been taken, which may be either too low or too high. There has been much discussion on this point. The cost per brake horse power per hour for London comes out very low—viz., from 0·087d. to 0·103d.; for the third case (for the Midlands only) 0·047d., assuming that the prices of slack delivered are fairly right.

Table VI. is a summary of the five tables of cost of fuel only per brake horse power per hour in London, arranged in order of merit for the more usual working conditions of heat efficiency of the different heat motors.

TABLE I.—*Steam Engines and Boilers.*

COST OF FUEL ONLY PER BRAKE HORSE POWER PER HOUR (100 TO 1000 HORSE POWER ENGINES).

No.	Place.	Heat Efficieneies.		Heating Value (Lower) of Coal per Pound.	Cost of Coal per Ton Delivered.	Cost of Coal per Pound from Column 5.	Number of Thermal Units in Coal Purchased for One Penny.	Theoretical Heat required per Brake Horse Power per Hour (Joule).	More Heat required per Brake Horse Power per Hour for the Percentage of Efficiency taken in Columns 2 and 3.		*Cost of Fuel only per Brake Horse Power per Hour.*
		Steam-Engine per Brake Horse Power.	Boiler.						For Steam-Engine.	For Boiler and Engine.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
		Per Cent.	Per Cent.	T.U.	s.	d.	T.U.	T.U.	T.U.	T.U.	d.
1	London	18	65	15,550 Best Welsh.	30	0·161	96,500	2544	14,130	21,730	0·225
2	London	13	65	14,000 Ordinary.	17	0 091	153,800	2544	19,570	30,100	0·196 Usual case.
3	London	8	65	12,000 Small coal.	15	0·080	150,000	2544	31,800	48,920	0·326
4	Midlands . . .	8	65	12,000 Small coal.	7	0·037	324,000	2544	31,800	48,920	0·151

TABLE II.—*Producer Gas and Gas-Engines.*

COST OF FUEL ONLY PER BRAKE HORSE POWER PER HOUR (50 TO 350 HORSE POWER ENGINES).

No.	Place.	Heat Efficiencies.		Heating Value (Lower) of Gas per Cubic Foot.	Fuel used in Generator; Cost per Ton Delivered; and Heating Value of Fuel (Lower) per Pound.	Cost of Fuel per Pound used in Generator.	Number of T.U. in Fuel Purchased for One Penny.	Theoretical Heat required per Brake Horse Power per Hour (Joule).	More Heat required per Brake Horse Power per Hour, for Efficiencies taken in Columns 2 and 3.		*Cost of Fuel only per Brake Horse Power per Hour.*
		Gas-Engine per Brake Horse Power.	Generator.						For Gas-Engine.	For Generator and Engine.	
		Per Cent.	Per Cent.	T.U.		d.	T.U.	T.U.	T.U.	T.U.	d.
1	London . . .	24	65	145*	Anthracite Nuts, 30s.; 15,550 T.U.	0·161	96,500	2544	10,600	16,300	0·169
					Gas Coke, 20s. per ton; 12,000 T.U.	0·107	112,000	2541	10,600	16,300	0·145
2	London . . .	19	65	145	Gas Coke, 20s.; 12,000 T.U.	0·107	112,000	2544	13,390	20,600	0 184 Usual Case.
3	London . . .	14	65	145	Do.	0·107	112,000	2544	18,170	28,000	0·250
4	Manchester . .	19	65	145	Gas Coke, 15s.; 12,000 T.U.	0·080	150,000	2544	13,390	20,600	0·137

* For anthracite, the heating value of the gas made is often 155 T.U. per cubic foot.

TABLE III.—*Lighting Gas and Gas-Engines.*

COST OF GAS ONLY PER BRAKE HORSE POWER PER HOUR (1 TO 20 HORSE POWER ENGINES).

No.	Place.	Heat Efficiency of Gas-Engine per Brake Horse Power.	Heating Value (Lower) per Cubic Foot.	Price of Gas in London per 1000 Cubic Feet.	Price of Gas in London per Cubic Foot.	Number of Thermal Units Purchased for One Penny.	Theoretical Heat required per Brake Horse Power per Hour (Joule).	More Heat required per Brake Horse Power per Hour for the Percentage of Efficiency in Column 2.	*Cost of Gas only per Brake Horse Power per Hour.*
		Per Cent.	T.U.	s. d.	d.	T.U.	T.U.	T.U.	d.
1	London	25	600	2 3	0·027	22,222	2544	10,176	*0·458*
2	London	18	600	2 3	0·027	22,222	2544	14,130	*0·636* Usual case.
3	London	14	600	2 3	0·027	22,222	2544	18,170	*0·818*
4	London	18	600	3 0	0·036	16,670	2544	14,130	*0·847*

About 30 cubic feet of lighting gas = 1 lb., at standard temperature and pressure.

TABLE IV.—*Oil-Engines.*

COST OF MOTOR OIL ONLY PER BRAKE HORSE POWER PER HOUR (5 TO 100 HORSE POWER ENGINES).

No.	Place.	Heat Efficiency of Oil-Engine per Brake Horse Power.	Heating Value (Lower) of Oil per Pound.	Cost of Gas from the Oil.	Cost of Oil per Pound (6d. per Gal.) ·80 Sp. Gr.	Number of Thermal Units Purchased for One Penny.	Theoretical Heat required per Brake Horse Power per Hour (Joule).	More Heat required per Brake Horse Power per Hour for the Percentage of Efficiency in Column 2.	*Cost of Motor Oil only per Brake Horse Power per Hour.*
		Per Cent.			d.	T.U.	T.U.	T.U.	d.
1	London	27	19,000	..	0·75	25,333	2544	9,420	*0·372*
2	London	20	19,000	..	0·75	25,333	2544	12,720	*0·502* Usual case.
3	London	14	19,000	..	0·75	25,333	2544	18,170	*0·717*

Motor oil taken at 6d. per gallon delivered, ·80 sp. gr. = ¾d. per lb.
(Light petrol spirit used for motor cars is more than double this price, and the sp. gr. is about ·68.)

TABLE V.—*Mond Gas and Gas-Engines.*

COST OF COAL ONLY PER BRAKE HORSE POWER PER HOUR (250 TO 500 HORSE POWER PLANT, WITHOUT RECOVERY PLANT).

No.	Place.	Heat Efficiencies.		Heating Value (Lower) Gas per Cubic Foot at 15° C. Saturated.	Slack Coal for Generator; Cost per Ton Delivered; and Heating Value (Lower).	Cost of Coal per Pound for Generator.	Number of T.U. Purchased for One Penny.	Theoretical Heat required per Brake Horse Power per Hour (Joule).	More Heat required per Brake Horse Power per Hour for Efficiencies taken in Columns 2 and 3.		*Cost of Coal only per Brake Horse Power per Hour.*
		Gas-Engine per Brake Horse Power.	Mond Generator.						For Gas-Engine.	For Generator and Gas-Engine.	
		Per Cent.	Per Cent.	T.U.		d.	T.U.	T.U.	T.U.	T.U.	d.
1	London . . .	26	70	148	14s.; 12,000 T.U.	0·075	160,000	2544	9,780	13,980	*0·087*
2	London . . .	22	70	148	Do.	0·075	160,000	2544	11,560	16,520	*0·103*
3	Midlands (near a colliery) . .	24	70	148	7s.; 12,000 T.U.	0·037	320,000	2544	10,600	15,140	*0·047*

Gas sold for about 2d. per 1000 cubic feet if recovery plant; 1000 cubic feet of Mond dry gas at 0° C. weigh about 62·66 lbs.
Sp. gr. = ·788; 15·7 cubic feet = 1 lb.

TABLE VI.—*Summary of the Five Tables of Cost of Fuel only per Brake Horse Power per Hour.*

[Most usual cases and in London.]

No.	Generator or Boiler and Type of Heat-Engine (in London).	No. of Table.	Approximate Powers.	Heat Efficiency of Engine.	Heat Efficiency of Boiler or Generator.	Name of Fuel.	No. of Thermal Units for One Penny.	*Cost of Fuel only per Brake Horse Power per Hour*
			Horse Power.	Per Cent.	Per Cent.		T.U.	d.
1	Mond gas and gas-engine .	5	250 to 500	22	70	Small coal	160,000	*0·103*
2	Power gas and gas-engine .	2	50 to 350	19	65	Gas coke	112,000	*0·184*
3	Boiler and steam-engine . .	1	100 to 1000	13	65	Coal	153,800	*0·196*
4	Oil-engine	4	5 to 100	20	none	Oil	25,333	*0·502*
5	Lighting gas and gas-engine.	3	1 to 20	18	none	Lighting gas	22,222	*0·636*

Discussion.

The PRESIDENT said they ought not to begin the discussion of this valuable paper without a word of appreciation of the work done by the late Mr. Bryan Donkin. They were nearly all acquainted with him, and would all agree that he was a most genial and kind-hearted man, always ready to place at the disposal of his engineering brethren what knowledge he possessed. He was thoroughly unselfish, and must have spent a considerable amount of time and thought in conducting the experiments on the steam-engine which were associated with his name. Those who looked through the proceedings of the two Institutions of Civil and Mechanical Engineers would see evidence of the esteem in which he was held by experimenters on steam engines and boilers. He was a devoted student of the steam-engine, and perhaps more than anyone else contributed to the explanation of the condensation which was known to take place inside the cylinder when superheated steam was not used. In many ways he had added to their knowledge of steam-engine practice. They would be only doing honour to themselves by placing on record their sincere regret at the death of Mr. Donkin, and their appreciation of the services he rendered shortly before his death in producing this paper.

Mr. JONES remarked that, as there seemed no disposition to discuss this very valuable contribution, it might be worth while to point out that Mr. Donkin was a representative trader who would have been an ornament to any scientific institution. He was on the Council of the Institution of Mechanical Engineers and a full member of the Institution of Civil Engineers. He was a very good illustration of a case where a man engaged in business on a large scale devoted himself to the higher ranges of scientific research, and whose name became known throughout Europe, although still engaged in trade. A trader of that kind must certainly be worthy of any compliment that any association, no matter how distinguished, could pay him.

THE ILLUMINATING POWER OF THE GAS OF THE FUTURE.

By Harry Edward Jones, M.Inst.C.E., of London.

What is this to be? In other words, what is the gas of the future to be? Clearly a calorific gas—and the cheapest in the true sense of what will be the most generally useful to the consumers, having regard to the cost of its production and distribution. As a purely illuminating coal gas clearly cannot satisfy this condition, it may be asked: Is a double system of distribution possible, economically speaking, for general purposes? Mond apparently thinks so, in certain cases. The late Bryan Donkin thought so, by his notable valedictory speech at the meeting of the Crystal Palace Gas Company.

The author respectfully differs, except in such very special circumstances as may be found in parts of Lancashire and Staffordshire, where a very cheap low-grade calorific gas might be required in such volumes that a separate distributing system would pay. The practical demonstration of this is now awaiting us in the development of the Mond scheme in Staffordshire, in connection with the Bill which the author found no difficulty or conflict of interests in supporting, for the simple reason that it obviously implicated a service which no statutory illuminating gas company could undertake, or would care to undertake, without the assistance, in such special districts as made it useful, of the Mond system. The Mond gas is a very low-grade gas, of great weight relatively to coal gas, and could never be produced or distributed except in volumes we should consider enormous, and at prices we should consider (looking to our capital expenditure and our means of production and distribution) as impossible.

The final question which we must address ourselves to practically solve is how far we can go, within the limits of the elasticity of our means, in bending or stretching our methods, to approach the power-fuel demand, without sacrificing our existing business, which we have in spite of all competition and obstruction, legislative and municipal, found to be so profitable that we should be unwise to tamper with it, much less to let it slip from us. What, then, is practically open to us? We may best consider this by a patient review of the present conditions, as presented to many of us practically engaged in this great service, which never promised to be more generally useful or important.

Table A.—*Particulars of Send-Out of Gas by the Commercial Gas Company.*

—	March 5, 1892.	March 5, 1901.	Increase.	
	Cubic Feet.	Cubic Feet.	Cubic Feet.	Per Cent.
During 12 hours, from 6 a.m. to 6 p.m.	4,721,000	3,979,000	742,000	15·70
,, 5 hours, from 6 p.m. to 11 p.m.	4,281,000	4,156,000	125,000	2·90
,, 7 hours from 11 p.m to 6 a.m.	1,455,000	1,451,000	4,000	0·02

Note.—These figures are more than confirmed by the experience of the Wandsworth and Watford Gas Companies. Both of these Companies lose stock through the hours of daylight, gaining only between 11 p.m. and 6 a.m.

Those engaged practically in the daily supply of gas, where modern facilities are offered to the consumers, cannot fail to have been struck with the ever-increasing demand in recent years during the hours of daylight and during the summer months, while, on the other hand, the maximum hourly send-out during the hours of darkness seems to be comparatively stationary, or at any rate not to be increasing in anything like the same ratio. See Table A, where the day consumption grows at the rate of 15·7 per cent. per annum, and the night consumption at the rate of 2·9 per cent. during the five hours of heaviest consumption, and 0·02 per cent. in the next hours, almost certainly due to the very wide adoption of incandescent burners, which the Company are pushing with great activity, having in view electrical competition. Even where such particulars are not recorded in detail, the obvious facts of the decreased requirement for storage of gas compared with the output, and the increased call for capital outlay for stoves and internal fittings, and further demands from power consumers for special discounts or abatements of price for trade uses, must have made themselves felt. Such observers must have experienced keenly the necessity for meeting the imperative demand for a cheaper fuel in a gaseous form than it was at the moment open to them to provide.

Considerations such as these induced the author to advise the adoption of such substantial discounts as 10 per cent. and 20 per cent. respectively, according to the quantities used for power purposes, where such could be shown to be chiefly required in the daytime, and led him further to encourage the summer use of gas by the working classes by supplying them at a discount of 5 per cent. upon the combined charge for the use of fittings and for the gas. Table B illustrates the consumption in the summer quarters contrasted with the same consumption in the winter quarters of coin-meter consumers, compared with ordinary consumers, wherein the summer ratio in the case of the ordinary consumers is only 34·6 per cent. of the whole, while the coin meter ratio is 49 per cent. of the whole.

Table B.—*Particulars of the Sale of Gas, Ordinary and Coin Meter Supply, during the Winter and Summer Quarters of the Year* 1901, *by the Commercial Gas Company.*

Quarter ending	Ordinary Consumers.	Coin Meter Consumers.
	Cubic Feet.	Cubic Feet.
Lady-day, 1901	713,000,000	50,500,000
Midsummer	453,000,000	49,500,000
Michaelmas	427,500,000	57,000,000
Christmas	729,000,000	63,500,000

Looking to the relief of capital otherwise required for storage and distribution, which arises on such increased summer and day supply, it is clear that this policy was well justified. But this does not go far enough; and when the present conditions of the use of gas for illumination are considered, it must be clear to the meanest capacity that any extra cost incurred for enrichment, which increases the illuminating power apart from the calorific value, is sheer waste, when we have without special complications, such as compression, &c., easy means of getting 20 candles illuminating power per cubic foot of gas.

In such an assembly as this, one need not labour this point, which, if not so patent to those whose product is less rigorously tested than in London, is very clear indeed to those who, like the author, have for twenty seven years past been under a system in which not only are the tests and instruments from time to time brought up to a standard of microscopical differentiation, but at the same time the system is administered by an authority distinctly hostile, where not an hour's deviation is allowed to escape the most rigorous enforcement of the legal provisions. Such a system, working all day long and every day for the closest investigation, requires that, to escape the cost and odium of penalties, any accepted standard has to be safeguarded by an ample margin, found in the author's case to amount to 4½ to 5 per cent.

Of late years, owing to the exhaustion of the best seams of common coals, the illuminating power of the gas yielded from Durham coals has gone back quite half a candle; while, on the other hand, the photometer alterations by the London Referees has demanded at least another half candle. Again, the due maintenance of the statutory limit of 16 candles has to be supplemented with the factor of safety of 0·6 of a candle (in the year ending Dec. 31, 1901); 16·67 candles being the average illuminating power supplied by the Commercial Gas Company. This has cost from year to year, as shown by Table C, not less than 1·17d. per 1000 cubic feet extra when employing carburretted water gas, or say 1½d. extra per 1000 feet when using cannel. This adds 8 to 12 per cent. on the net cost into the holder.

Table C.—*Statement of the Cost of Enrichment per* 1000 *Cubic Feet in the Case of the Commercial Gas Company.*

Year.	Per 1000 Cub. Ft. of Gas Made.
1901	1·17d.
1900	1·41
1899	1·33

Note.—This was at least 40 per cent. greater when cannel had to be used, before the use of water gas.

From the examinations of various authorities into the relative heating power, it is beyond a doubt that this expenditure availed little or nothing to the fuel or power consumers, or to those who used the incandescent burners. In proof of this, M. Verdier, in his paper to last year's congress

of the Société Technique de l'Industrie du Gaz en France,* showed (Table D) that a reduction of illuminating power so considerable as to involve the consumption of 26 per cent. more gas in the Bengel burner, and even 30 per cent. in the incandescent burner, is only accompanied by a reduction of heating power of 14 per cent. Again, Messrs. White, Russell, and Travers, in their valuable paper to the Michigan Gas Association, in February,† gave some extremely valuable returns of the effect on the Welsbach incandescent light of using gas of very widely differing calorific power. Their experiments very clearly and forcibly demonstrated that, while there is little relation between the light emitted by a flat-flame or ordinary burner and the calorific value of the gas, there is a very close relation indeed between the amount of light the gas gives in an incandescent mantle and the calorific power, even through the extreme ranges to which they directed their valuable research.

TABLE D.—*Extract from M. Verdier's Paper.*

Titre du Gaz au Bec Bengel.	Pouvoir Calorifique par M.C. de Gaz.	Consommation a 1 Bec A. Incandescente par Carcel-Heure.
95·64	6·264	14·26
120·20	5·388	18·54
Diff. 24·56 = 26 per cent.	0·876 = 14 per cent.	4·28 = 30 per cent.

It may safely be said that the "gas of the future" will be neither producer nor water gas. Producer gas cannot be reasonably distributed, because it is not generally useful on account of its poor calorific value—say, 150 B.T.U. per cubic foot—and its high specific gravity, ·814, which is nearly twice that of coal gas. It is, therefore, clear, that as compared with coal gas, something like four-and-a-half volumes must be used to get the same heating effect or power; and its specific gravity being roughly twice as great as that of coal gas, it follows that the distributing plant must deal with a weight nine times greater. This presents a very serious difficulty, except in such abnormal conditions as exist in some parts of the manufacturing districts, where fuel gas might be required in works closely adjacent to each other in such large volumes as could be dealt with by very large mains and under pressures to be measured in pounds per square inch. The question of capital and the practical difficulties of accommodating such conduits in the streets and roads, would be nearly insurmountable, under ordinary conditions, in our cities and towns; nor could any such undertakings as the members of this Institution are dealing with, make any such departure, either in the form of duplicated systems of mains or in converting their own system.

Before passing from the consideration of this sort of gas, it must be clear that where you replace 50 per cent. of hydrogen with 50 or 60 per cent. of nitrogen, you are exchanging a valuable heating gas of low weight for an inert diluent of heavy gas, to say nothing of the other change of constituents which tend to make the producer gas of inferior utility. It is, besides, obvious that, even at the low cost of production of such gas, the larger volume required goes far to bring it, to the average probable user of power or heat, up to a cost very nearly equal to that at which coal gas is already being supplied.

Water gas, apart from sentimental objections, cannot in this country be made with reasonable economy, except alongside of coal gas, which furnishes the necessary carbon in the form of coke. It also has, *per se*, a lower calorific power—viz., 304 B.T.U.; and though it partly compensates for this by the higher degree of flame temperature obtainable from it by a larger use, and so accomplishes the same ultimate heating effect, its weight (sp. gr. ·642) offers considerable difficulty in economic distribution compared with coal gas. Indeed, working with the proportion only necessary for reasonable enrichment, the author has found very great trouble in obtaining either equal deliveries of volume on systems of mains, or equal pressures at distant points, without adding to the pressures used by considerable proportions—say, from 5-10ths to 8-10ths additional pressure according to the proportion of water gas employed. He would point out here that, unless this necessity be kept in view when, from time to time, this gas is used for emergency purposes, it is likely to cause great disappointment, and give rise to complaint by the consumers who depend upon it for maintaining the action of atmospheric heating and cooking stoves and for light-giving purposes. It has become an axiom of the author that the weakest parts of the distribution system are at once revealed if any considerable proportion of carburetted water gas be used.

Having these questions in view, he has been considering how far coal gas, which admittedly has the highest calorific value, and is the easist distributed, can be stretched in the sense of increasing the volume at the expense of the illuminating power, without causing such serious detriment to its calorific value as would be material, bearing in mind the production from a ton of coal of the largest quantity of low-grade illuminating gas, supplemented by such a quantity of water gas as could be provided from the surplus coke available from the coal gas production—such water gas to be enriched as far as possible by the use of all the volatile constituents of the tar, or, if necessary, with such a moderate amount of oil gas as shall bring it up to a useful calorific standard. The following series of experiments has been initiated to determine these factors:—

TABLE E.

	Ordinary Heats and Exhaust.			Extra Heats and Exhaust.		
Coal	Gas Per Ton.	B.T.U. per Cubic Foot.	Coke.	Gas Per Ton.	B.T.U. per Cubic Foot.	Coke
	Cubic Feet.		Cwt. Lb.	Cubic Feet.		Cwt. Lb.
B	10,340	672	12 66	12,928	556	12 56
W	10,360	616	14 22	12,344 (23·4 p.c.)	541	14 00
P	10,160	691	14 22	12,500	577	13 64
H^1	10,630	652	13 104	12,000	588	13 64
H^2	10,120	628	13 44	11,392	569	13 00
L	9,600	669	14 12	11,414	591	13 104

TABLE F.—*Statement as to the Illuminating Power under Ordinary Conditions and Extra Heats, showing the Testing of 5 Cubic Feet Actual Consumption by the London Argand.*

Ordinary Heats and Exhaust.		Extra Heats and Exhaust.		
Gas per Ton.	Illuminating Power.	Gas per Ton.	Illuminating Power.	Theoretic Illuminating Power.
Cubic Feet.	Candles.	Cubic Feet.	Candles.	Candles.
10,000	15½	11,750	9·5	12·90
10,500	16	13,500	6·2	12·50
10,080	17	15,360	6·4	11·15
10,087	16	13,440	5·6	12·15

TABLE G.—*Observed Ratios between the Illuminating Power and Calorific Power (Mr. Greville's Tests).*

Illuminating Power.	B.T.U. per Cubic Foot.	B.T.U. per Candle.	Remarks.
16·5	672	41·0	Five tests
16·6	691	41·6	
16·4	672	41·0	
16·6	669	40·3	
16·0	652	40·8	Three tests
15 6	652	41·8	
16·2	628	39·0	
15·4	616	40·0	
13·8	591	42·5	
13·8	588	42·4	
13·5	577	42·7	
14·3	569	40·0	
13·9	556	40·0	
12·9	541	41·9	
Average of 20 tests . . .		41·0	

Besides these experiments, the following equivalents have been given by other authorities:—

Mr. H. A. Humphreys, in his paper on the Mond gas, attributes 675 B.T.U. to coal gas (presumably London or Birmingham gas); and Mr. H. F. Hills, in his articles on "Gas" contributed to the "Builder," gives 624 B.T.U. for coal gas. Taking the illuminating power of these two tests to range between 15·5 and 16·5 candles—say a mean of 16 candles—the B.T.U. per candle would be 40·5.

Mr. Arthur Paddon gives 580 B.T.U. for 14-candle gas. This works out at 41·5 B.T.U. per candle.

M. Verdier gives the figures of 601 B.T.U. for the low-grade gas and 709 B.T.U. for high-grade common coal gas. Taking the mean as 15 candles (the French work usually to a 12-candle standard) gives 43·6 B.T.U. per candle.

The average of five experiments on 16·5-candle Stepney

* See "JOURNAL," Vol. LXXVIII., p. 514.
† See *ante*, p. 892.

gas gave 672 B.T.U., equal to 41 units per candle. Three subsequent tests of 16-candle gas gave 652·8 B.T.U., which works out at 40·8 B.T.U. per candle. The gas used in these three tests, mixed with 5 per cent. of air, gave a calorific value of 616 B.T.U.; and with 10 per cent., 574·4 B.T.U., as an average of three tests. The same gas gave an illuminating power with the Welsbach burner of 40 candles, and when mixed with 5 per cent. of air of 40 candles; with 10 per cent. of air, 38 candles.

These tables must not, however, be regarded as final, because the time afforded to the author by the invitation for his paper has not given the scope he would have wished for the repeated examinations desirable; and, such as they are, they serve to show that still further investigations are necessary.

It appears that with Durham coal it is possible, by increasing the heat and diminishing the pressures upon the retorts, to increase the product per ton of coal by 25 per cent., and in so doing to substantially increase the calorific effect, but not so largely as might be expected in proportion to the higher rate of production.

A striking illustration is afforded of the impropriety of limiting the consumption of gas by the "London" Argand burner to 5 cubic feet, as in the lower grades of power it practically annihilates it, and stands in plain contradiction to what may be practically observed in an ordinary burner.

From the results shown in the foregoing tables, and applying the figures of an ordinary year's working, the cost into the holder of unenriched coal gas would, for 10,000 cubic feet of 15·3-candle gas, be 12d. per 1000 cubic feet. If the quantity be increased to 11,500 cubic feet of 13·31-candle gas, the cost will be reduced to 10·43d. per 1000 cubic feet, having a heating power of 544 B.T.U. per cubic foot. Plain water gas, equivalent to 304 B.T.U. per cubic foot, will cost:

	Per 1000 Cub. Ft.
With coke at 8s. 4d. a ton	2·25d.
Purifying, wages, wear and tear	3·50
Together	5·75d.
The addition of carburetted hydrogen, in the shape of gas oil, which is stated by Professor Lewes to be capable, with water-gas production, of giving 130 cubic feet of 50-candle gas per gallon, to the extent of 1¼ gallons, would cost at 2¾d. per gallon (believed to be a reasonable average price)	3·43
This brings up the cost of the mixture to	9·18d.

and it would add 162·5 cubic feet of gas, having a calorific value of 225,000 B.T.U. Adding 837·5 cubic feet of plain water gas, with a heating value of 304 B.T.U. per cubic foot, we have 254,600 B.T.U. We so get 1000 cubic feet of gas with a heating value of 479 B.T.U. per cubic foot.

If, therefore, we add as much of this gas as will exhaust 1000 lbs. of the coke obtained from the manufacture of 11,500 cubic feet of coal gas, we get the following mixture:—

Cub. Ft.	Per 1000 Cub. Ft.	
11,500 of unenriched coal gas at 10·43d.	120·0d	to 544·3 B.T.U.
20,000 of carburetted water gas at 9·18	183·6	to 579·0 ,,
31,500 costing	303·6d.	

or an average price of 9·6d. per 1000 cubic feet for gas having an average heating equivalent of 502 B.T.U. Interest on capital on this at 5 per cent., which is higher than the rate at which capital is now raised, at say

	Per 1000 Cub. Ft.
£300 per million cubic feet works out at	3·60d.
Rates and taxes	0·75
Distribution, salaries, wear and tear	1·50
Management, bad debts, &c.	1·50
Making a total cost for interest, distribution, rates, management, &c., of	7·35d.
Which added to the cost into the holder as above of	9·60
Makes a total cost for the gas of	16·95d.

Say 17d. per 1000 cubic feet. So that against 16-candle gas, having a calorific value of 640 B.T.U., at (say) 2s. 8d. per 1000 cubic feet, we should be able to supply gas of 502 B.T.U. at 1s. 5d. per 1000 cubic feet.

If, as suggested by Professor Lewes, the use of any considerable part of this expensive gas oil can be replaced by using the hydrocarbon constituents of tar—say 4 lbs. per gallon—it is obvious that further economy can be realized. Again, if, as seems probable from certain experiments made by the author, the distribution of a small percentage of air along with the gas be desirable, as stimulating the thermal effect and as dispensing with the necessity for compressing the gas as now practiced in the best systems of incandescent lighting, there would, of course, be a further saving to a greater extent even than the volume of air so introduced.

If it be asked why we should lower the calorific value of the gas we make, the reply is that, on present lines, we can supply that value at prices bringing it within the reach of the largest consumers, and securing their confidence in its adoption. There is undoubtedly an impression that lighting gas, powerful as it is, is too dear for industrial purposes. For such purposes there is certainly a demand, if it is to be got at such a price as not to seriously handicap its use, in the possible—and indeed probable—events of the misuse, waste, or imperfect combustion for want of due adjustment, by agents and servants.

If relieved of the burden of enrichment by expensive materials which return no residuals; if scope be given to employ coals of lower quality (for illuminating power), such as exist in much larger quantities than the best class gas coals; if freed from the refinements of purification, which I have shown press so expensively and so harassingly on the producer; if the surplus coke and tar from the ordinary process can be so appropriated that relief will be given to that over-production which has of late years so largely abased their value, and which, in the matter of coke, the constant increase in coin-meter stoves tends to augment in a duplex ratio, as calling for more gas and less coke—much of the costs and losses would be removed which disable us from meeting the demand and getting the suffrages of those requiring power and fuel on a large scale, by giving an abundant supply at a price which would favourably compare with any other known means.

It is not suggested, nor does it seem necessary, to accomplish this change by any sudden wide departure, but rather by a gradual modification of the existing methods. For example, 14-candle gas is the most general quality supplied in this country; there actually remain isolated cases of a 12-candle standard. It would not be a difficult step to go to 12 candles, with a corresponding reduction in price to the consumer, and at an early date.

If it be borne in mind that 12 candles, and even lower, is the quality of gas widely used on the Continent, and entirely so in the case of a Company with which the author is connected, where no less than 12,000 cubic feet of gas per ton of coal are usually produced by the managers, and where such gas is extensively used in ordinary burners without any observable defect, it must be obvious that there would be no danger or great public inconvenience arising from making this change. The further step of descending to 10 candles would require probably some notice to consumers accustomed to 12-candle gas, and necessitate the introduction of different burners.

At the moment of writing, a notification has just been given that incandescent burners are now to be supplied by the Welsbach Company, of the Sunlight type, at 6d. each, and a similar burner, as shown by the author, with mantle, stem, and all fittings, was bought at 8½d. The present price of mantles (3d.) would make it easy for the gas companies to induce their customers to make the change.

In framing his estimate, the author has felt that the most convenient and useful gas with which to supplement the low-grade coal gas would obviously be low-grade carburetted water gas, because it is of a lower specific gravity and of a higher heating power than any of the producer gases, and it is free from the objections attached to them of containing a large volume of inert gas, or indeed any beyond such proportions of nitrogen and carbonic acid as usually occur in coal gas. During the stages of the change, the ordinary burner used might be an argand with a larger gas-way and diminished air passage, perhaps supplied with some regenerative arrangement; and for rougher purposes a bats-wing burner with wider slit, worked at lower pressure.

Purification.—As to the degree of purification to be employed, it is obvious that the only impurity which is unprofitable to remove—viz., bisulphide of carbon—would, under these conditions, be spread over so large a volume, that its proportion would be reduced from 10 to 31 inversely; and as on the incandescent system the consumption of gas to obtain the same light is reduced by at least four-fifths, it is clear that the sulphur would be, by the mere force of conditions, reduced in its effect to one-fifth part of one-third part (say, one-fifteenth) of the 45 grains per 100 cubic feet normally contained in crude gas, so that the consumer would receive 3 grains where he now receives 20 grains. The sulphuretted hydrogen would be reduced by the dilution of volume coming from the extra gas per ton, and by the

addition of two parts of carburetted water gas, in which the proportion of sulphuretted hydrogen is not more than one-third that in ordinary coal gas, so that here the cost per 1000 cubic feet for purification would be largely reduced; and it must be borne in mind that, having regard to the value of spent oxide, the cost of purification from sulphur by that means is very small.

Distribution.—This could be accomplished by pressures not largely exceeding those now employed, as the specific gravity of the mixed gases would not be greatly in excess of that of ordinary coal gas, and far below that of water gas or producer gas; and as the volume to be supplied for equal thermal effect would only be reduced as from 640 to 502, there would not be much greater weight to be carried by the mains under pressure.

Charges.—The cost of inspection and the wear and tear of the distribution plant would necessarily be reduced by the larger volume of gas which would almost certainly be used at the lower price for domestic heating purposes.

Capital Charges.—The outlay of capital and the cost of interest thereon would be less, as the capital involved in water-gas plant is much below that of coal-gas plant, and the latter would produce 15 per cent. more gas than under present conditions, while the purifying apparatus and operations generally would be simpler and cheaper.

Management Charges.—The management, again, would demand a smaller charge, by the extra volume supplied without increase of staff.

Increased Consumption.—That such larger volume would necessarily be wanted, is clear from the consideration of the great facility for the temporary use of gas-stoves during the spring, summer, and autumn months, at a time when the trouble and cost of a coal fire puts it out of competition. The operation of this development has already been largely realized, as pointed out in the early part of this paper, and, as the effect of saving in storage and distributing plant, would again react on the much larger volumes contemplated under this system, it would render possible the supply at the price suggested.

Concluding Notes.—Having in view the question which has been so largely ventilated lately in the schemes presented for parliamentary sanction for the distribution of power by hydraulic pressure, electric current, and by Mond gas, and specially noting the remarks made by the late lamented Mr. Bryan Donkin, it is clear that there exists a considerable demand for the distribution of power, which the gas companies would do well not to ignore or treat with indifference because they already enjoy a profitable business. The Mond scheme, though one which could not possibly be undertaken by an illuminating gas company, and which did not propose to undertake the duty of supplying gas at all for lighting, excited a great deal of attention and opposition—showing there was good foundation for their action.

No one who goes about among industrial works can fail to have noticed the advantage of the electric current for conducting power and actuating small machines for driving portable tools, and can have failed to regret that the makers of gas-engines have not as yet put into our hands a small and portable motor for separate action for drilling, screwing, riveting, and operations about the structure of a boiler, a ship, or any large machine in course of construction.

It is clear that, where gas can be supplied at anything under 2s. 6d. per 1000 cubic feet, it does succeed at present in very easily holding at bay the electric competition for lighting purposes. This is illustrated in the southern part of the Metropolis, where the public lighting has been retained successfully by the South Metropolitan and Wandsworth Gas Companies—entirely, it is believed, by reason of their low selling price.

Were we but furnished with the means of applying the gas which is more easily distributed, and with less loss by leakage, &c., than any other form of power, on a small motor suitable to be easily shifted about with a tool, there is very little doubt that we should equally hold the field in competition with electric power.

The belief of the author is that a gas not unsuitable for direct illumination, containing from 500 to 510 B.T.U., supplied at 17d. per 1000 cubic feet, would hold its own against Dowson gas of 150 B.T.U., manufactured as it is at about 6d. per 1000 cubic feet, and against Mond gas of 155 B.T.U., professedly to be supplied at less than 4d. per 1000 cubic feet. That aim must be the excuse the author makes for troubling the Institution with a paper at a somewhat early stage of thought, and with the experiments in a somewhat crude condition, suggested to him by a question twice asked of him in the present session of Parliament: "What did he believe would be the tendency of future enterprise in regard to the illuminating power of the gas of the future?"

Discussion.

The PRESIDENT said they must all feel grateful to their Vice-President, Mr. Jones, for taking up at such short notice this important subject, and treating it so very carefully and from so many points of view. He could sympathize with the remarks the author made, that the production of a paper of this character required some considerable time for thought, and for the necessary experiments to be put into operation, in order that the data might be sufficiently accurate for the purpose of making deductions therefrom. He (the President) had every reason to believe that the subject was one which would receive full discussion, for it had occupied a great deal of attention recently, and appeared to be one of the questions pressing for solution.

Mr. C. E. BOTLEY (Hastings) said the paper was a most important one at the present juncture, and was entirely one after his own heart. He had for many years felt the desirability of being able to utilize gas-works for the production of gas to be used for fuel and power purposes; but unfortunately, there were restrictions which prevented them from being so combined, and difficulties owing to prices. It appeared, however, that the tendency of the age was towards a reduction of illuminating power; and they might hope in the future to get some relief from the restrictions which were now placed upon it. This would open the field for using gas-works very much more largely than at present. It was particularly necessary that they should now increase the output of their works. The incandescent mantle, which was so rapidly coming into use, owing to the cost being reduced and the restrictions being done away with, would undoubtedly—except in cases where there was a rapidly developing district—tend to lower the consumption. This had been already felt in many places where there were no manufactories; and therefore they required some other means to stimulate the demand, if they were to continue the rate of progress which had been customary in the past. He deplored the fact that there was not any small motor available for use where electric motors were brought into play. Recently, in going through some large railway works, he had seen that, though gas had supplanted steam to a great extent in driving the machinery in large shops, yet in nearly every case the electric motor had so many advantages in portability and adaptability that it had been introduced, though he was happy to say that the power was generated by very large gas-engines. He had recently been endeavouring to see what could be done in the production of electric power for traction or for lighting by means of the gas which the author suggested as an easy one to use—poor-grade carburetted water gas. Using this in a high-power gas-engine attached to an electric motor, one would get nearly the same result as with ordinary coal gas. This poor-grade gas had been produced in a very simple way. They merely stopped the oil going into the carburettor, and passed the blue water gas through the purifiers. They were quite aware that a certain quantity was deposited in the purifiers; but this was sufficient to give it the necessary calorific value to make the engine work properly. The result was rather unexpected; and it also had the effect of cleaning the purifiers, and rendering them more efficient for the usual manufacture of carburetted water gas. From what he had seen, he felt quite certain that gas-works would have the means of producing power very cheaply. It was a matter of regret that the time had gone by when they could have combined on the works the production of electrical energy with the manufacture of gas, because no doubt it would not only have been a great advantage to gas companies, but would also have benefited the consumer. With regard to the conditions of supply, he should say that, in his experience, the day consumption of gas was practically the best now; and he had heard it stated that in many places in the South the consumption between twelve and two o'clock on Sundays was the heaviest of the week. If they could get a more uniform load, which the manufacture of power gas would give, it would, of course, tend to reduce the general cost of all the gas. In bringing forward his paper, Mr. Jones had laid a debt upon them which he (Mr. Botley) appreciated very much; for he had given them an opportunity of discussing a point which was of great interest at the present moment.

Mr. J. D. Ashworth (Portsea) said he, too, had had great pleasure in listening to the paper, which supported what he himself brought before the meeting last year—the desirability of reducing the illuminating power of coal gas. He had made several notes on the paper on points in which he agreed with the author. In the first place, with regard to the increase in day consumption, there were a great many consumers who used gas-stoves for cooking purposes. Upwards of 64 per cent. of his consumers now had stoves, and the day consumption was much heavier than it used to be. During twelve hours of the day, the increase had gone up enormously. With regard to the coal used, not only had the illuminating power decreased, but also the yield of gas, because they did not seem to get so much per ton as they did a few years ago. There was one reason why an extra pull on the exhaust would be an advantage, because a bigger make per ton would be obtained, and the carriage of raw material, which was a considerable item when one had to bring the coals 500 or 600 miles from the pit's mouth, saved. On the question of the cost of gas, Mr. Jones brought it down to 1s. 7d. per 1000 cubic feet, which was different from the figure in his (Mr. Ashworth's) paper last year. They wanted to reduce the illuminating power now in order to compete with the electrical industry. They had a great many consumers who had gas-stoves, and the question was, When all of them were supplied, what was the next step to be taken to increase their business? The only thing would be to get back some of the customers who had left them for electric lighting—in other words, have an increased gas consumption. This they might be able to obtain if they could sell gas at 1s. 6d. or 1s. 7d., instead of at the present price of 2s. 3d., per 1000 cubic feet.

Mr. F. W. Cross (Leyton) said, with all due deference to the greater experience and knowledge of the author, he should like to say that he was not altogether at one with him in his conclusions; in fact, he did not seem quite at one with himself, because he admitted that some of his figures were inconclusive, and required much more investigation. Upon reading the paper first, he (Mr. Cross) was inclined to think that the author was trying to fly before he could walk; but, on looking at it again, it struck him that there was an object in his mind, and that he wrote the paper to get at that object and prove it, though, of course, he might be wrong. The author no doubt had placed before them a valuable contribution, on which they had to work to get other results, as the figures now given were not wholly conclusive. Going through the paper in detail, he could not quite agree with the author, with regard to Tables A and B, in his conclusion that the great increase in the output of gas was due to fuel gas, or to the use of gas for cooking purposes. He took the 5th of March as the date, giving the output of gas, and comparing the day consumption with the night. By the side of this, he should have placed the winter day and night consumption for lighting purposes. Referring to Table B, the summer consumption of the coin-meter consumers was 49½ million cubic feet—almost equal to the mid-winter consumption; whereas by the ordinary consumers it was nearly half in the summer. The coin-meter consumers used the gas for cooking in the summer; but the greater proportion of gas in the winter was burnt for lighting. So with the ordinary consumers, the greater proportion was employed for lighting. How were they going to deal with the slot consumers, in regard to their fittings, with the low-grade gas? He was quite in agreement with the author in coming down to 14-candle gas; but when they came to 10, 8, and 6 candle, and supplying a whole community such as London, with all its underground cellarage, all its back yards, and shops and warehouses, with incandescent burners, how was it going to be done? They were bound to supply a great deal of the gas to be used with the ordinary flat-flame burners; and, on consideration, everyone must come to the conclusion that there was an enormous percentage of gas employed for lighting purposes only which was used solely with flat-flame burners, and the percentage consumed with incandescent burners would be found to be quite small in comparison. [Mr. Jones dissented.] Mr. Jones shook his head; but if they looked at the houses they would see incandescent lights in the dining-rooms, but on going upstairs they saw half the lights flat-flames. He believed a greater proportion of the gas used in and around London for lighting purposes was still consumed with flat-flame burners. Where did they see a butcher's shop lighted with incandescent gas-burners? They were very few and far between. They wanted a good flame; and it was very difficult indeed for anyone to get a butcher to put an incandescent burner in his shop window. In Table C, Mr. Jones had given the cost of water gas; and he said the enrichment to maintain the statutory limit of 16 candles, or 16·67 candles for the average, cost him 1·17d. per 1000 cubic feet extra when using water gas, and 1½d. extra when using cannel. He was sorry he could not agree with these figures. There were so many collateral advantages with regard to water gas, that he did not think the cost of enrichment could possibly be so much as that. He would ask Mr. Jones to give the cost of his water gas as compared with coal gas.

Mr. Jones said the coal gas last year cost 16·88d., and the oil gas—the carburetted water gas—18·01d.

Mr. Cross said he must contradict that figure. In his opinion, the cost of enrichment was not correct; it should not be so great. The average illuminating power of the gas was 16·67 candles, as stated in the paper. His average quality for the year was 16½ candles, which was very close.

Mr. Jones said that the 1·17d. was not last year only, but the average of three or four years, during which he had been using carburetted water gas instead of cannel.

Mr. Cross said it was given in Table C for 1901 as 1·17d., and the cost of the carburetted water gas was 18·01d., while that of coal gas was 16·88d. He had no doubt these figures were taken from the balance-sheet. Figures taken from his own Company's balance-sheet for the last half year gave the cost of coal gas as 22·54d., and that of carburetted water gas at 18·88d.; and he did not think this would show that the cost of enrichment by carburetted water gas was very great. Turning to Tables G and E, he had worked out the figures in Table G, and applied them to Table E; and he had evidently been rather misled, because he had taken the last three items of that table as compared with the first item. The author there referred to the first figure as being his own average of five experiments with 16½-candle gas. He took that one, and then had taken the last three as coming towards the quality spoken of in the paper—viz., 14·3, 13·9, and 12·9 candles. The proportionate selling price, taking the 16½-candle gas at 3s. per 1000 cubic feet—would be 2s. 6d. per 1000 feet for the other. If they took these prices and worked them out on Table E, with the figures there given, it produced figures which were unsatisfactory; and therefore he was pleased to hear the author say that the table was inconclusive.

Mr. Jones remarked, with regard to the illuminating powers in Table G, that the last three were theoretical.

Mr. Cross said he found, on examining the table, and calculating it out, that the figures were inconclusive. There was something wrong, but he could not find out where it was. He did not get the proper value out of the 12,000 odd cubic feet; he did not seem to get the cash value for the units given. There was a return on the 16½-candle gas of 31s. per ton, but on the 14-candle gas it was about 32s. If the figures were inconclusive, they might have misled him.

Mr. J. T. Lewis (Wellingborough) said the paper was very valuable, and full of points of great interest; and they were matters which would have to be dealt with individually later on. The few words he wished to say on the paper were on the subject of the consumption of gas during the hours of daylight; and they would fully bear out the statements that Mr. Jones had made. If he had seen the paper before he came to the meeting, he would have brought the actual figures showing his consumption during the various hours of the day. But, roughly, his day consumption from the middle of November to the middle of February was about 40 per cent. of the total yearly output. If they took the six weeks from the middle of February to the end of March, and from the beginning of October to the middle of November, taking the average, the output would be about equal for the hours of daylight and the hours of darkness. But taking the summer consumption, from the end of March till the end of September, on the average amounts, he found his consumption ran very much like this: From 6 till 8 o'clock in the morning, they lost stock to a slight extent; from 8 till 10.30, it was practically stationary; from 10.30, when the slot cookers and other cooking-stoves were brought into use, they had a very serious decrease in the stock; from 1 to 2 o'clock—the dinner hour—the stock increased; and from 2 till 6, it was practically stationary. He could assure the gentleman who had just sat down that in the winter time cooking-stoves took a very large proportion of the day consumption; and there was no doubt in his mind that this consumption; through the use of cookers, was going to be very much larger than it was at present.

Mr. E. A. Harman (Huddersfield) said the paper was a very interesting one, but, to adopt the author's words, they must take it more in the form of a sign-post, indicating further experiments on the same lines. He should like to ask one question with regard to the paragraph in which the author said he had tested 16-candle gas with a Welsbach burner, and had obtained 40-candle power, and he used 2·4 cubic feet of gas to obtain it. Then he said that with a mixture of 5 per cent. of air he obtained the same candle power, and with 10 per cent. of air 38 candles. Was the same quantity of gas used—namely, 2·4 cubic feet—in each of these respective tests?

Mr. Jones: Yes.

Mr. Harman said respecting the output of gas during the day, from 8 to 9, 9 to 10, 10 to 11, and 11 to 12, he had had some very remarkable experiences. When the sun had come out on a brilliant day, and gas manufacture had ceased, they had had the holders steadily rising. He did not know how they were to obtain these beautiful figures, showing so many cubic feet of gas at various hours during different climatic conditions in such an accurate way.

Mr. T. Goulden (London) said he should like to ask a question with regard to Table F, more especially the two last columns. There was the theoretical illuminating power, which he supposed was a reduction of the illuminating power calculated from the increased quantity of gas made. He should think that perhaps the actual illuminating power he had, which was very much short of the theoretical, was probably due to the greatly increased heats he must have had in his retorts to get the high quantity, and that he must have split up his ethylene and produced carbon and methane. This, of course, would also decrease the heating power of the gas. That seemed to be the case from Table G, where he saw there was an equal calorific ratio—an equal number of British thermal units per candle practically for all the illuminating powers obtained. This was a little at variance with the information he had been able to obtain (though there was very little extant) with regard to the calorific value of low-power gases. But the trend of opinion, in one direction at any rate, was that of supplying a lower-power gas without dilution or adulteration. If they were going to give the public a low-power gas produced on these lines, the calorific ratio must increase as they dropped the illuminating power, or the amounts deducted from the price now charged must be very much more than they were at present. According to this table, presuming they had 3s. 6d. as the initial price now for 16-candle gas, the worth of 14-candle gas to the public would be only 3s. 1d. This was a very important matter to deal with; and if these figures were correct, they knocked pure unadulterated 14 or 12 candle coal gas out of the market altogether. Mr. Jones had also given a rather low price for the coke; and this was a factor which, of course, entered into the question, though not to a very great degree. The figure of 8s. 4d. per ton was very low; and he should suggest that his coke, instead of being worth 2·25d., would be worth a great deal nearer 3d. or 3·25d. It was almost needless to draw attention to the fact that nothing had been said in the paper, or by any speaker, with regard to the circumstance that this gas which Mr. Jones proposed would contain an enormous increase of carbonic oxide. With regard to the cost, Mr. Jones said the paper was a sign-post and not a milestone; and he (Mr. Goulden) hoped that he was not going in the direction here pointed out, or at any rate that he would stop at the next milestone. He made out the total cost for gas to be 17d. per 1000 cubic feet; and then he understood him to say that 2s. 8d. was the price he was recently selling at. So that they would be able to sell gas of 502 B.T.U. at 1s. 5d. per 1000 cubic feet. He presumed Mr. Jones did not propose to give the gas away without any profit to the Company, and therefore this figure must be increased; and he should think it would be brought up very much nearer to 2s. 8d., because nothing beyond the cost of the gas could have been included in the 1s. 5d.

Mr. Jones said they did not want any profit other than the interest on capital at 5 per cent., which was included.

Mr. Goulden said an allusion to power was put at the end of the paper. It struck him that they could very well supply power from coal gas by small gas-engines driving compressors for pneumatic tools, which were very economical and were universally applicable.

Mr. A. G. Glasgow (London) said he supposed he had been invited to join in the discussion of this very interesting paper on account of the cordial reception in the technical press and by Mr. Jones of a communication of his bearing directly on the subject. He was all the more willing to appear there because it afforded him a good illustration of his point of view, and the more willing to discuss the paper because he quite agreed in the author's belief that if a gas not unsuitable for direct illumination, containing from 500 to 510 B.T.U., could be supplied profitably at 17d. per 1000 feet to the consumer, it was a "consummation devoutly to be wished." But while quite recognizing that Mr. Jones did not attempt to lay down any hard-and-fast lines in a paper of this character—that, using his own description, it was simply a sign-post pointing out the direction in which to work—he thought he could convince at least himself that the finger on the sign-post was pointing in the wrong direction. He would be as brief as possible, and try to get to the kernel of the matter. Mr. Jones, by dispositions which he had described, suggested the possibility of supplying gas of from 500 to 510 B.T.U. against the present gas of 640 B.T.U., with a reduction in price of 15d.—viz., from 32d. to 17d. Consequently, the paper ought to show some means by which to save that 15d.; and he (Mr. Glasgow) would ask them to consider where there were any means indicated approximating to the possibility of such reduction. When they reckoned the calorific power, the whole result depended upon the figures they employed; and they must, within their means of accuracy, be accurate, if the conclusions were to be of any use. Some of them might expect him to see good in any application of water gas; but he did not. He claimed to see good only in the profitable application of carburetted water gas; and he was now going to start by challenging the usefulness of the carburetted water gas Mr. Jones had employed. He had estimated the cost of a mixture of carburetted water gas containing 1¼ gallons of oil at 9·18d., with a heating effect due to the oil of 225,000 B.T.U. According to the figures he himself accepted—and they were the only ones he could use—he had for his own work arrived at a total calorific value per pound of oil of this character of 18,600 B.T.U. The weight of this 1¼ gallons of oil was about 10¾ lbs., giving (provided every drop of the oil was converted into gas, with no tar residue and no carbon residue, and an efficiency of 100 per cent. in the process), 200,000 B.T.U. He thought it was reasonably moderate to assume an efficiency of 90 per cent. with a perfect conversion of the oil into gas; and this would give 180,000 B.T.U. for the oil, which when introduced into the mixture of low-grade coal gas gave an average heating value of 470 B.T.U. for the mixture. He had made no change in the coal gas, which he had taken at 544 B.T.U., but the water gas he corrected, as the result of his own experience, to 435 B.T.U. for gas carburetted with 1¼ gallons of oil. He would now go from this cause to the effect. Taking 640 B.T.U. of the ordinary gas at 32d., and the mixture now arrived at, with his amended calorific power of 470 B.T.U., he found that there was a reduction from 640 to 470 B.T.U. for the mixture, or 26½ per cent. This was the first point he started from—that this mixture involved a diminution of the heat delivered to the consumer of 26½ per cent. They had already jeopardized the luminosity; but he cared nothing for that. They must, however, have a standard of some sort. If there were no standard of luminosity, there must be a standard of heat; and consequently they must give to the consumer a compensating reduction on the selling price for the 26½ per cent. diminution, which worked out to 8½d. per 1000 cubic feet. In other words, to give the consumer the same amount of heat, regardless of the fact that he was not getting the same amount of light in an open flame, they must reduce the price from 32d. to 23½d. to put the consumer on the same basis as he was before. Leaving out his amendments or alterations of the calorific power, and taking Mr. Jones's own figures on the same basis, they must make a reduction of 6·88d., or nearly 7d., per 1000 cubic feet. Where were they to find a saving equivalent to this? Where was even a compensating saving to be found, apart from the 15d. altogether? They had an item of cost in which the cost of gas in the holder was given as 9·6d. Now, the only disposition he saw in the paper to effect any saving was in the making of gas and putting it into the holder. The question of selling more gas by a sweeping reduction in the cost, might be applied to existing methods. The only point that the estimate could rest upon must be that it should show in the manufacture of the gas a saving equivalent to the reduction one must allow to a consumer in order to give him the same heat for the same money. For introducing any new methods, one generally wanted something to the good

beyond simply remaining stationary. He had not touched upon the question of flame luminosity, because he regarded this, for the purpose of his argument, as immaterial; and he would assume that everybody used an incandescent light. This was his main criticism—and it was simply carrying out the hypothetical case which he had recently communicated to the "JOURNAL OF GAS LIGHTING"—that they must give the consumer his compensation in the selling price; that their saving must be in the cost of manufacture; and that they must save such a percentage of the cost as would equal the percentage on the much larger price (which was the selling price), before they could afford to make any change. He would next point out one or two matters which might be worth notice. He could perhaps throw a little light on this question of variation in the cost of enrichment by carburetted water gas. Some people would give enrichment as a *plus* cost, others would give it as a *minus* cost, simply because, in the one case, the water gas came to more, and in the other case to less, than the unenriched coal gas. This was evidently the case of both Mr. Cross and Mr. Broadberry; and it was the case at Tottenham, as stated by the Chairman of the Company. Mr. Woodall said they were making their enriching gas at 3d. per 1000 cubic feet less than their coal gas, and that was with oil at 3½d. and 3⅝d. per gallon. If they supposed the figure Mr. Jones had taken was a fair average price, this would be increased to about 5½d. It seemed strange, to one who had not thought about it, that under the same conditions the carburetted water-gas plant in a coal-gas works might be operated so that enrichment might be a cost or might be a saving; but he could make that clear by stating that the cost of enrichment depended, of course, upon the cost of the gas to be enriched, the cost of the enriching gas, the candle power of the gas, and the proportion in which the gases were mixed. Mr. Jones said he produced only the quantity of water gas necessary for enrichment, and consequently he must make his water gas very rich. No matter at what price of oil or how economically they might work the plant, if they made the gas of sufficiently high candle power, carburetted water gas would cost more than coal gas, using a reduced quantity of very high quality, but a quality higher than the original gas; and consequently the enrichment became an expense. At Lea Bridge and Tottenham, they made the quality of carburetted water gas sufficiently high for enrichment, but not so high but that it was much cheaper than unenriched coal gas, and they mixed a much larger quantity. So that, whereas Mr. Cross and Mr. Broadberry might save, Mr. Jones might show an expense, and all be perfectly right; it simply depended upon the way in which the two gases were manipulated. With reference to the value of enrichment, Mr. Jones gave his cost of enrichment at various amounts for different years, averaging 1·3d. per 1000 cubic feet of gas made. The enriched gas was 16·23-candle, and people seemed to assume that any unenriched gas would work out at about 14 candles; so that there might be 2½ candles of enrichment. If such enrichment was carried out, it deserved very serious consideration from the calorific point of view. Mr. Jones said enrichment cost from 8 to 12 per cent., leaving out the question of coke; and he also stated, from examinations of various authorities on heating power, that this expenditure availed little or nothing to the fuel or power customers, or to those who used incandescent burners. He quoted from a table given by M. Verdier. It seemed to him (Mr. Glasgow) that the table absolutely disproved the statement that the expenditure availed nothing to the users of incandescent burners, because it showed that the result of the enrichment of 26 per cent. flame luminosity really gave an increased incandescent effect of 30 per cent., though the heat value was only 14 per cent. According to the table, they obtained more than the corresponding effect with the incandescent light, and this additional something might have an effect on the calorific power.

Mr. JONES remarked that this was not enriched gas—only using ordinary coal gas.

Mr. GLASGOW said in any case there was the difference between the low-grade and high-grade gas; it was a richer gas, however effected. The author further referred in complimentary terms to the very valuable researches of Messrs. White, Russell, and Travers, extending over two years, presented during the last two sessions to the Michigan Gas Association; and he cited these as upholding his statement that the increased flame luminosity of enrichment availed nothing to consumers of gas for fuel or power purposes, or to those using the incandescent light. It was true that with a mixture such as they were discussing—of ordinary coal gas and carburetted water gas, which simply kept up the calorific power of coal gas—the increase of 2 per cent. was practically maintained, giving an augmented flame luminosity of 12 per cent. and an additional incandescence effect of 12 per cent. It was a bold statement, therefore, to say that the enrichment of gas availed nothing for incandescent lighting or for calorific power.

Mr. W. KING (Liverpool) said the title of the paper was "The Illuminating Power of the Gas of the Future;" and in the first paragraph the author asked what would be the most generally useful gas of the future to the consumer. This was the point to be looked at. After very long experience, he had come to the conclusion that it was extremely difficult to lay down one particular line as being applicable to all consumers, to all towns, and under all conditions. They might take towns in which the gas was of a certain illuminating power, and even in them some might be residential and others manufacturing; they might take others where the gas was of lower quality, and others again in which it was of a very high light-giving value; and all these circumstances must be taken into consideration in the settlement of the question as to what was the best illuminating power for any particular case. They might be divided somewhat into classes. There were towns in which a very large proportion of the gas consumption was in manufactories and works, and for motive power purposes. There might be others where only a small quantity of gas was used in this way; and very possibly the gas there might answer if it was of very indifferent illuminating power. Speaking as representing a company who supplied one of the highest illuminating power gases in the kingdom, he could not shut his eyes to the fact that a very large proportion of the consumers in Liverpool used the flat-flame burner—a point which had been already alluded to. It might be said that many of such consumers were wanting in common sense, and that if they could get so much more illuminating power out of an incandescent burner, they should use it. But they had to take facts as they were; and, speaking for his own town—and perhaps it was the experience of most gentlemen present—it would be found that, with the middle and lower classes of consumers, the burners were flat-flame, either batswings or fishtails. In dealing with the question of illuminating power, they had to look at the duty these people got—what light, in fact, they obtained for a certain amount of money. After all, in a large measure, it was not a question of price per 1000 cubic feet, but what was the amount of the gas bill. This was what consumers looked at. If in one case they were able, by means of a particular quality of gas and a special kind of burner, to get a certain amount of light for 2s., whereas in another town, by means of a flat-flame burner, they had to consume ever so much more gas, but at a greatly reduced cost, they might find the increased quantity multiplied by the smaller price worked out to as much as the smaller quantity of the high-quality gas. This was a very important point; and certainly, speaking for his own locality, he could not lose sight of the fact that a very satisfactory light was given—certainly 16 candles—for a consumption of 4·8 cubic feet in a flat-flame burner. Those gentlemen who were supplying gas of lower quality might work out these figures, and see what quantity would be required at their quality. With regard to the question of power, they had a high-quality gas, which gave very good results both for power and for heating purposes. The penny-in-the-slot consumer, as a rule, was one who would only with difficulty use an incandescent burner. It was a long business to introduce these burners among that class of consumers. Then with regard to economy exercised in the higher class of houses and of consumers, the President had already touched upon this point. Whatever economy they might show (of cost) over electricity by the use of the best incandescent gas-burners, there were a certain number of people to whom the amount of the gas bill was a matter of indifference or insignificance, and who, in spite of the advantages which could be shown—whether high or low power gas, or flat-flame or incandescent burners were used—would insist, either from fashion or from some other cause, upon having electricity; and with these consumers it was impossible to deal. He would not occupy any more time, but he would very seriously ask the members to consider this question before rushing into the idea that an extremely low quality of gas would be the best for all classes of consumers. They must not forget that they catered very largely at present, and would do so in

the future, for those who were not in a position to disregard the amount of their gas bills. In these days of cheap oil, and so on, enrichment of gas could be effected very easily; and this was another reason why they should hesitate—some of them, at all events—before a great reduction was made in illuminating power. Where the gas was supplied of extremely high power, it might be a question whether a moderate amount of reduction could not be made, though not, perhaps, to the extent which had been hinted at.

Mr. JONES, in reply, said he was very glad that they had had a good discussion, and that he had a great deal to answer. It was not the first time he had stood a considerable amount of criticism, and he hoped to stand a little more. With respect to Mr. King's remarks, it was all very well to talk about the present outlook of cheap oil, but they were paying 2⅛d. per gallon, and he had had offered at 1⅝d., or something like it, a new kind of oil. But six months ago he was paying 4½d. per gallon for what he was now getting for 2⅛d. No matter how favourable the consumers of Liverpool might have been to the use of flat-flame burners, he could not understand what they were about; for anything more wasteful and extravagant he could not conceive than for a man to deliberately turn his back upon a saving of three-fourths of his gas bill. He (Mr. Jones) might say frankly that he had gone the length of putting the 8½d. burner into the cottages of his own gardener and groom. He quite agreed with Mr. King that they could not lay down a rule which would suit every place exactly—at any rate, they could not until they got this burner; but he thought that was the great lever. Nothing had happened in the history of gas for the last thirty or forty years to touch it. He read a paper recently in which he said that this was a thing which marked the great change in the use of gas; and Liverpool must be a very old-fashioned place if it turned its back upon it. Now he came to his ancient foe, Mr. Glasgow, to whom he was extremely indebted for giving him some light which he badly needed; and he hoped they would continue, as they had been in the past, the best of friends. With regard to his remarks on M. Verdier's paper, he was bound to say that his results did not agree with the American experiments. He attributed this to the fact that in the Bengel burner they were using, the effect responded exactly to the real normal illuminating power of the gas. Mr. Greville, when working for him, found the greatest possible difficulty, as he increased the volume of the gas per ton, in getting at what was the real illuminating power of the gas. As he (Mr. Jones) explained shortly, they had at last to get from Mr. Sugg another sort of burner—an argand—something quite different from, and much inferior in construction to, the "London" argand, though better for their purpose. When he had to compile the table, he looked out what the theoretical illuminating power of the three experiments in the table would be; and he found, in ratio to the larger proportion of the original illuminating power, it came out, curiously enough, to the 40 units, which he took it was a very important thing. He confessed he expected the units of thermal efficiency to go up very much per candle as it went down; and so it did with the candle power, as revealed by ordinary methods, up to as much as 55 instead of 40. This immediately caused him to look at it with suspicion; and by varying the burner in the way he explained, he first of all—disregarding the 5-feet limitation, and giving a 3-inch flame with the "London" standard burner, then shortening the chimney and using a 4-inch one—found the maximum possible consumption which would give the best light product, no matter how high the flame. Therefore he thought M. Verdier's experiments might be correct, though he doubted whether the Bengel burner he worked with really gave the proper illuminating power. He (Mr. Jones) adopted his result because it did show this, if it showed anything—that with such burners as one now had the illuminating power fell a great deal faster than the thermal effect. This was what he commented upon in M. Verdier's paper. There was another view of the matter which Mr. Glasgow had left out. Enrichment, where it was imported in this way abnormally, and not in the ordinary make of the gas, was an expensive thing. First of all, it did not carry.

Mr. CROSS said that was not the fact.

Mr. JONES said he found the proof of his statement in the operation of cleaning out the mains, which was one of the factors he particularly looked out for. Again, enrichment caused smoking in ordinary burners; and even with incandescent burners waste would often be seen going on—the cone of flame being above the mantle, showing imperfect adjustment—and sometimes the mantles were damaged by a deposit of carbon upon them. There was waste by smoke and waste by misuse. The new system gave the consumer a cheaper article, he was relieved from the smoke waste absolutely, while as to the misuse he could disregard it, because the waste went on on a cheaper basis. With respect to the different costs, as to which Mr. Cross and Mr. Glasgow were so much in opposition to himself, what was really the difference? What was charged to the water gas? It all depended upon that. If they simply charged to the water gas the proportion of wages spent upon it, and wear and tear, it was not sufficient, because there was a staff on every gas-works for dealing with repairs, another for the supervision of the gasholders, and there was the wear and tear connected with the mains about the works, and the cleansing of them. He was in the habit of making up in this fashion an estimate which he had already shown in that room. First of all, the cost for oil, and the residual tar and ashes were of no value; and then came the cost of purifying. When oil was 4½d. per gallon, some people continued to purify carburetted water gas with oxide of iron. He contended that, even when lime was dear, it was not so dear as oil at 4½d.; and the most detrimental thing to illuminating power was carbonic acid. He therefore added, in his case, not much less than 2·11d. per 1000 cubic feet for purifying; but if this were done by oxide of iron, they might save three-fourths of that. Then he put on not only wages paid on the works, but even the salaries of himself and other people connected with it. Then he transferred a sum from the general account for the staff of foremen, supervision, standing charges, and wear and tear outside the mere carbonizing repairs. In this way one might get a more accurate—at any rate a heavier—bill against the water gas than the other way. But the most trenchant part of Mr. Glasgow's criticism was where he tried to show that he (Mr. Jones) was wrong in the saving he proposed to effect. There was a little weak point there, as he explained that the constitution of the special hydrocarbons with which they enriched the carburetted water gas was a difficult matter. But Professor Lewes had told them—and this was the point—what they could get from oil compared with Mr. Glasgow's calorific value. With regard to illuminating power, Professor Lewes said:

> With a duplex oil-lamp, you can get 1120 candles from a gallon of oil. In the Young process of retorting, where you have nothing but the solid carbon and the oil-gas left, we get 1200 candles of illumination from a gallon of oil. But we can go even beyond that, because in the carburetted water-gas processes it is quite possible to get up as high as 1300 candles per gallon, simply because during the process of decomposition—during the baking of the oil into oil gas—the molecules of the hydrocarbons are kept from over-decomposition by the water gas which is diluting and surrounding them.

He took Professor Lewes's higher stage, and applied a rough-and-ready calorific power calculation to it, and then got the thermal value of his total gas to 502 B.T.U. Mr. Glasgow told them it was only 470. He was very glad to get that from such an authority (which he really respected in these matters), for not much was known about water-gas production in this country. He certainly did value Mr. Glasgow's view on the matter, and he was quite willing to accept 470 units as against the 502. The whole difference between them was as to whether there would be a diminution in price of 21½ or 26½ per cent. He (Mr. Jones) would make Mr. Glasgow a present of the odd 5 per cent., and not grieve very much. Mr. Goulden, he thought, agreed with most that he (Mr. Jones) said, except that he could not see where the profit on the capital had been put in. But he had taken 5 per cent. for that. Mr. Harman and Mr. Lewis practically concurred in most of the views expressed in the paper. Then he came to Mr. Cross. In the figures he gave that gentleman, he had only included the cost in the last half year; but in the early part of the half year he was paying 4½d. per gallon for oil, and this made an addition to the net cost from which he must take an average of as much as 4·36d. Then coke was very dear in the early part of the year—half as much again as recently. This would come to another 2d. He had only brought with him the figures for the last half year; but in the paper he had given the average for the year, and they must add 3·96d. for the extra cost of the oil in the early part, and he could not say exactly how long that lasted. They had a contract to June or a little beyond it, he thought, at the old price; but then there would be 2d. extra. The coke, as Mr. Goulden reminded him, he had given too low; but he wished to put it as favourably as possible for water gas. He was neither an opponent nor an

advocate of water gas; he looked upon it with the cold grey eye of impartiality. When it was useful, he used it; and when it was not, he stopped it. It could be very useful as an auxiliary in a coal-gas works; but, in his opinion, it was an utter mistake as a supplement to, or as a replacer of, coal gas. Its best effects were only obtained when used as an auxiliary. The remarks both of Mr. Ashworth and Mr. Botley concurred so much with his own experience, that he need not say anything with reference to them. Only one word in conclusion. When recently asked, in the witness-chair, "What do you think about this?" he knew at once if he could get rid of cannel and oil as enrichers, and really get back to the normal illuminating power of common coal (and that not the very best of the kind), he should escape a lot of extra cost. He had dwelt upon this matter in the paper, simply treating it in the right way. He then had no idea of going much below 14 candles; but the discussion, and the working at the paper, encouraged him to pursue the idea. If he learned anything worth having, he did not say he would promise another paper, but he would send his figures to the Secretary, because he certainly was prompted to go further in this direction. What he had done had been simply to start his chemist at work; and the result of his experiments he had given to the members for what they were worth. If they were encouraged, they would go along; if not, they would stop where they were, and he would go on by himself. He liked, above everything, to give his own personal observation and work, without any bias or advocacy. He had nothing to extenuate, nor, on the other hand, anything to exaggerate. The paper had, at any rate, given rise to a good afternoon's talk, and it possibly might be of some use. He must apologize for its crude and incomplete condition; but he would repeat what he said at first—instead of sixty experiments, they wanted hundreds, and of a closely analytical character. As they might be aware, the examination of gases was very difficult. He was no chemist himself, but his sympathies were with the chemist. The members probably knew this, because analysis was perhaps one of the most difficult, troublesome, and tedious things in the whole range of chemical investigation.

On the following day,

Mr. JONES said he wished to add just a few words to the discussion on his paper, to clear up what looked like a discrepancy between his experience and that of gentlemen (like Mr. King and others) who used carburetted water gas. On the previous day, he made the bold statement that it did not entirely carry; and he wished to justify it. He used water gas occasionally on lines somewhat outside the general experience of those present. If he were using only 20 per cent., or even less, enrichment, he had to make a gas of 30-candle power; but his usual practice was to make it of 20 candles, and he had worked with only 14½ candles. In one case he got a high value, approximating to 8 candles per gallon of oil; but in his ordinary practice, using 20-candle gas, he only got a value of 7 candles. When, however, he went to 30-candle carburetted water gas, he got a value of a little over 6 candles. He attributed the chief difference to the imperfect carrying of the excess of oil in the gas. He found, when making the higher gas, that the purifying material showed its presence; and he came across traces of it in the mains. Above all, he found greater results in the clearing away of naphthalene from certain pipes, which the members would recognize as being in a crucial position in the matter of naphthalene. Certain of his mains passed under a number of dock entrances, some of them close to the place of manufacture; and these were always catch-pits for naphthalene. He had found it when it had been necessary to change the ordinary 20-candle enrichment gas to 30-candle, when, of course, he made a smaller quantity, and the extraordinary reduction of pressure showed that it had acted immediately upon the naphthalene. He attributed the action of carburetted water gas in the reduction of naphthalene in such a marked degree, entirely to what might be called the surplus oil scattered through it, in the same way that Mr. Botley scattered it at Hastings by his high-pressure jet spray.

Mr. GLASGOW has since favoured us with the following communication:—

To the Editor of the "JOURNAL OF GAS LIGHTING."

SIR,—Mr. Jones, with some negligible preliminaries, requests me to formulate my proposition in detail, so that my errors may be exposed. If he is seeking only errors in my conclusions, I can understand his need of further assistance, when opposed by the stubbornness of facts. If, on the other hand, he will concede his own fallibility, and bring his mind to an impartial study of the case, he will find it sufficiently elucidated in my recent communications to your columns.

I might content myself with the foregoing acknowledgment of his letter; but his own paper, entitled "The Illuminating Power of the Gas of the Future," to which I had the opportunity of listening last week, illustrates my position so happily that I am tempted to review my arguments with that as a text.

In the discussion on his paper, Mr. Jones accepted my statement that the gross calorific power of his suggested "gas of the future" could not exceed 470 B.T.U. per cubic foot—as against his 640 B.T.U. for 16-candle gas; and he admitted the necessity of a *pro ratâ* reduction in the selling price, in order to provide the same heat for the money. This means a reduction of 26½ per cent., being 8½d. on his selling price of 2s. 8d.

Merely to preserve the calorific *status quo* (regardless of decreased flame-luminosity), it is first necessary that Mr. Jones's new dispositions shall effect a counter saving of 8½d. per 1000 feet. Now, by what actual changes—apart from a juggling of figures—does Mr. Jones propose to save this 8½d., to say nothing of his optimistic claim of a saving of 15d.? Is it by his reduction in flame-luminosity? Fortunately his figures reveal the extent by which this reduction in luminosity reduces his estimated cost per 1000 feet.

In building up the cost of his "future" gas, Mr. Jones starts with the assumption that, for an ordinary year's working, the cost into his holder of unenriched coal gas of 15·3 candles is 12d. per 1000 feet. He next deduces the cost of 10·43d. per 1000 feet of 13·31-candle coal gas. He then establishes the cost of water gas, carburetted with 1¼ gallons of oil, as 9·18d. per 1000 feet. With the two latter, he effects a mixture, containing 64 per cent. of carburetted water gas, costing 9·6d. per 1000 feet—candle power not stated, but gross calorific power not more than 470 B.T.U. per foot.

Now, if Mr. Jones will only add 1¾ gallons more oil per 1000 feet to his carburetted water gas (at his "reasonable average price" of 2¾d. per gallon), the cost of this gas will be increased, on his own basis of figuring, to less than 13d. per 1000 cubic feet. When this gas is mixed with his 15·3 candle coal gas, in the proportions assumed, the mixture, costing under 12·6d. per 1000 feet, will have a calorific value equal to his present 16-candle gas, and a flame-luminosity (with oxide purification only) of over 17 candles—say, 80 per cent. higher than that afforded by Mr. Jones's "future" gas.

Without change in any of the other conditions assumed by Mr. Jones, the expenditure of 3d. (12·6d., less 9·6d.) at the works recovers the preliminary reduction of 8½d. in present selling price, necessitated by the deficient calorific power of his "future" gas; while automatically effecting permanent (not vaporous) enrichment to over 17 candles. Conversely, the manufacturing saving due to the low grade of Mr. Jones's "future" gas is, on his basis of estimating, 3d. per 1000 cubic feet, and no more. But this low grade involves an immediate net loss to consumers, shareholders, or both, of 8½d. less 3d., or 5½d. per 1000 cubic feet, at his present selling price.

It will be useful to follow the process by which the above net penalty of 5½d. attaching to his low-grade gas becomes, in the hands of Mr. Jones, a net advantage of 15d. less 8½d., or 6½d., per 1000 cubic feet.

The first step in the analysis of all comparisons is to assure oneself that the figures are drawn from a common basis. The following table of Mr. Jones's published results shows, however, that his selling price of 2s. 8d. is based upon a manufacturing cost approaching 18d. for his unenriched coal gas, as contrasted with the 12d. for such gas upon which his "future" estimate is based:—

Year.		Cost per 1000 sold.		Cost of Enrichment.		Cost of Unenriched Coal Gas.
1901	about	19·50	..	1·17	..	18·33
1900	,,	21·69	..	1·41	..	20·28
1899	,,	16·03	..	1·33	..	14·70

This modest discrepancy of (say) 6d. is independent of the candle power of the gas, and at once reduces the gross saving ascribed to the low-grade gas from 15d. to 9d. per 1000 feet.

On Mr. Jones's basis of estimating, we have found the actual manufacturing saving due to his low-grade gas to be 3d. per 1000 feet. This leaves 6d. to be accounted for in the items of "interest, distribution, rates, management, &c." As is to be expected, this is the difference between present actual costs of these items to the Commercial Company and the greatly reduced figures with which Mr. Jones has charged his "future" gas.

Here, again, this reduction of 6d. per 1000 feet has no practical connection with the question of low-grade gas. It is due somewhat to lower interest, but especially to the greatly reduced capital charges and taxes for carburetted water-gas plant (which forms two-thirds of Mr. Jones's future gas-works), compared with coal-gas plant. Moreover, these capital charges will be lower per 1000 feet for the higher grade of carburetted water gas than for Mr. Jones's low-grade water gas, inasmuch as the same plant will yield a far larger volume of the richer gas. This fact off-sets any capital advantage that Mr. Jones attaches to the greater yield of low-grade coal gas per ton of coal, even did this not involve greater repairs due to the higher heats that are required.

The great saving in capital and similar charges by the substitution of carburetted water-gas for coal-gas plant was the chief feature of a paper I submitted several years ago to the American Gaslight Association, wherein I reduced these (and other) savings to their true cash equivalents. While I am more than glad to have Mr. Jones corroborate the remarkable, and generally unsuspected importance of these figures, I confess surprise at finding this distinctive saving in a process particularly adapted to high illuminating powers, attributed to low-grade gas.

His estimated saving in distribution, due to increased consumption of the low-grade gas, may well be equalized by the fact that, with the higher grade of gas, the consumer gets his heat at a much lower cost per unit, and will therefore use gas when it would otherwise be too dear.

In short, there is no actual advantage outlined in connection with Mr. Jones's "future" gas which does not apply equally to the high-grade mixture; whereas he starts out with a net handicap of 5⅜d. in his selling price, due to the deficient heating power of his gas compared with the high-grade gas. In addition, the high grade gas has whatever advantage attaches to 80 per cent. higher flame-luminosity.

These figures should be satisfactory to Mr. Jones, because, throughout, he is the authority on whom they are based.

His "reasonable average figure" charges high-grade carburetted water gas with 2d. per 1000 feet more for oil than the price at which oil is being offered on three-year contracts. But a substantial margin to the good is never undesirable. His future margin is on the wrong side, however, when he takes 12d. per 1000 feet for unenriched coal gas, which has averaged by his published statements about 15d. for the past ten years. In the present condition of the gas-coal and coke markets, it is a bold estimate which ventures to place this figure any lower than the past ten years average.

Far from establishing a case for low-grade gas, Mr. Jones, for a saving of 3d. in manufacture, must give calorific compensation (apart from the sacrifice of direct illumination) equal to 26½ per cent. of his selling price. Only when the selling price of his present gas is below 11½d. per 1000 feet, will this compensation not exceed the saving due to the low grade of his "gas of the future."

The original points of my previous communications are, therefore, again strikingly illustrated, viz.:—

I.—Disregarding flame-luminosity, any reduction in calorific power must be compensated for by a *pro ratâ* reduction in selling price.

II.—With carburetted water gas, such compensation is far greater than the saving in manufacture by reducing the flame-luminosity.

III.—Therefore, the efficient use of carburetted water gas demands the manufacture of gas of not less than present calorific power.

IV.—Such gas is necessarily of comparatively high luminosity—say, 18 to 20 candles.

V.—Therefore, the efficient use of carburetted water gas necessarily, and automatically, provides enrichment of the coal gas.

VI.—Carburetted water gas of such enriching power is much cheaper in the London district, and generally throughout the country, than common coal gas.

Hence I again conclude that companies purchasing the right to make low-grade gas at the expense of their powers of charge, are buying that which they cannot afford to utilize, at an expense which only the future can determine.

We are all, I take it, according to our means, striving to provide cheaper gaseous *energy*; but the fictitious catch cry of "cheap gas!" is on an intellectual plane with the American free-silver electioneering slogan of "cheap money!"

A. G. GLASGOW.

38, *Victoria Street, Westminster,*
May 5, 1902.

New Gas-Meter Testing-Station at Newington Causeway.—The London County Council have just had a new gas-meter testing-station constructed at Avonmouth Street, Newington Causeway; and Messrs. Parkinson and W. & B. Cowan, Limited, have completed its equipment. The apparatus includes two 20-feet test holders, six 10-feet, and two 5-feet, together with King's gauges, speed and leakage meters, &c., and all necessary fittings.

Institution of Civil Engineers.—At the annual meeting of the Institution last Tuesday, the result of the ballot for the election of officers for the ensuing session was declared. The new President (who succeeds Mr. Charles Hawkesley) is Mr. J. C. Hawkshaw, M.A.; the Vice-Presidents being Sir William White, K.C.B., Mr. F. W. Webb, Sir Guilford Molesworth, K.C.I.E., and Sir Alexander Binnie. Among the members of the Council are Mr. G. F. Deacon, Mr. G. H. Hill, Dr. A. B. W. Kennedy, Mr. Alexander Siemens, and Professor W. C. Unwin.

North British Association of Gas Managers.—The Secretary of this Association (Mr. R. S. Carlow) has issued the preliminary circular in regard to the forthcoming annual meeting, which will be held in Perth on the 24th and 25th of July, under the presidency of Mr. John Wilson, the Superintendent of the Tradeston Gas-Works of the Glasgow Corporation. Mr. Carlow reminds the members that the Committee are now making preparations for the meeting; and he invites contributions to the proceedings in the form of papers. He gives, as usual, a good list of subjects from which to make a selection.

The Improved Pelouze and Audouin Tar-Extractor.—Considerable interest having been evinced in the article on this subject published in last week's "JOURNAL" (p. 1096), it may be as well to point out that Messrs. W. C. Holmes and Co., of Huddersfield, possess the sole rights of manufacture in the British Isles of Mr. Guldlin's improved "Western" type of this well-known apparatus. Messrs. Holmes are supplying two 5 million cubic feet per day tar-extractors of this make to the new gas-works at Granton; and they have also orders for machines of lesser size for various works in England.

Key's Ventilating System.—Our readers may remember that some few years ago Mr. William Key, who was Engineer of the Tradeston Gas-Works of the Glasgow Corporation, commenced practice as a ventilating engineer, with the view of devoting his time to the exploitation of his "Plenum" system of warming and ventilating buildings by mechanical means. The system has already been adopted in the Paisley Infirmary and many other places, and at the present time Mr. Key is engaged in carrying it out in the new Old Bailey Sessions House, and in a portion of St. Thomas's Hospital. We learn that he is endeavouring to obtain permission to apply it to the House of Commons, the defective ventilation of which has lately given rise to much complaint, and been the subject of special investigation.

The Emergency Meeting of the Evening Star Lodge arranged to be held during Gas Institution week was a great success. The business of the Lodge was conducted in the Masonic Temple at the Hotel Cecil; and the banquet subsequently took place in the Victoria Hall. More than a hundred brethren connected with the Lodge and with the Institution and the Gas Institute assembled to witness the raising of Bro. Samuel Carpenter, the Manager of the Dorking Gas-Works. The ceremony was most effectively rendered by the W.M. (Bro. Arthur Valon) who was warmly congratulated on all hands later in the evening. A smoking concert (arranged by Bro. W. D. Child, I.P.M., and Bro. A. E. Broadberry, S.W.) contributed largely to the enjoyment of the proceedings.

Manchester District Institution of Gas Engineers.—The 130th quarterly meeting of the Institution will be held at Mansfield next Saturday, under the presidency of Mr. Arthur Graham, the Gas and Water Engineer to the Corporation. We learn from the programme issued by the Hon. Secretary (Mr. R. G. Shadbolt, of Grantham) that on reaching the town the members will be invited by the Gas Committee to partake of luncheon, after which the business will be transacted. It will consist of the consideration of the question of balloting for officers, &c., as recommended by the Committee, and the reception of the Committee's report on extending the scope of the Institution. The President will submit an illustrated sketch of Mansfield and its surroundings; and at the close of the business the members will visit the gas-works, and also the electricity works now in course of construction. In the afternoon they will inspect the water-pumping station, reservoirs, &c.; and on their return take tea together at the Swan Hotel.

ESSAYS AND REVIEWS.

THE PHENOMENON OF CATALYSIS.

From time to time, as the more familiar sciences seem to have almost lost their mystery, so that adept minds begin to flatter themselves that they know pretty nearly all about the matter, there breaks out some fresh puzzle which nobody can solve, although everybody can perceive that until it is solved there can be no real increase of knowledge. This is the case at the present time in the domain of chemical and electro-chemical physics; and the unknown factor which is exercising the minds of all the professors of these branches of science is "catalysis." When it is stated that the Nernst electric lamp is essentially catalytic in its action, while the luminous effect of the Welsbach mixture of thorium and cerium for incandescent mantles is more than suspected to be attributable to the same principle, the practical importance of catalysis becomes as apparent as its theoretical interest. Catalysis, then, formed the subject of an address delivered by Professor Ostwald to a German Society; and we are indebted to "Nature" for the abstract translation of this statement, which is understood to be a summary of the results of many years' study of the phenomena of catalytic action by the Professor and his pupils.

The idea and name of catalytic action were introduced into science by Berzelius so long ago as 1835, in connection with the work of Mitscherlich on the formation of ether. Berzelius pointed out that the action of sulphuric acid in this case was analogous to certain other actions, including that of platinum on combustible mixtures of gases. According to this acute observer of the phenomena in question, it consists in the remarkable fact that certain substances have, by their mere presence, and not by their affinity, power to arouse latent affinities in other substances; so that compounds undergo reaction and a greater electrochemical neutralization occurs. Berzelius made no attempt to explain the phenomenon. On the contrary, in a subsequent discussion with Liebig, he insisted on the great danger of attempting to explain incompletely understood phenomena by hypothetical assumptions, lest experimental investigation should thereby be hindered. It is a striking fact that every self-lighting gas-burner to-day acts by virtue of a property of matter which remains unexplained. It comforts one to know the action is "catalytic;" but there is as yet no getting beyond the name and understanding the thing.

Yet Professor Ostwald and his pupils have not been studying catalytic actions all these years for nothing. He distinguishes four different classes of such actions, which present various degrees of difficulty to the understanding. The simplest is the familiar phenomenon of the precipitation of solid matter from solution, by the addition of a small quantity of the same substance. It is scarcely necessary to remark how useful this action has been found to be for the softening of water. It can best be studied with a supersaturated solution of Glauber's salt, in regard to which the characteristic disproportion is well exhibited between the quantity of the acting substance and the quantity of substance changed by its influence. By a particle of dust far below the limit of what is ponderable, it is possible to bring an indefinitely large quantity of supercooled solution to congelation. The processes are not limited to supersaturated solutions of solids; they are applicable also to solutions of gas. In these cases, a trace of a gas may cause the liberation of an entirely disproportionate amount of another gas. Then, again, supersaturation is not limited to the liquid state. Vapours can be supersaturated in respect to liquids and solid bodies; and even in the case of solids, cases are known where they are supersaturated in respect to liquids—that is to say, that when they are brought into contact with a small quantity of the liquid, they are converted into liquid. The theory of all these phenomena is known. It supposes for the system in question a stability not the greatest possible under the given conditions of temperature and pressure. Something is wanting, which does not appear spontaneously. Let the absentee be supplied, and action is set going which proceeds until equilibrium is reached.

In the case of catalysis in homogeneous mixtures, the idea remains that the original system must not represent a stable condition; or else there could be no change without the addition of energy. It appears that these unstable mixtures are bound to alter with keeping, sooner or later; but the addition of a "catalyst" alters the velocity of the chemical reaction very considerably, without appearing in the final product. How it does this cannot be explained. It is practically impossible to specify examples of this action. Ostwald is content to state that there seems to be no kind of chemical reaction which cannot be catalytically influenced, and no chemical substances (whether elements or compounds) which cannot act catalytically. It is a quite safe generalization that a certain course of reaction takes place more quickly through an intermediate substance than it does directly. The rusting of iron, which goes on more quickly in the presence of carbonic acid gas than in its absence, is an illustration. The ordinary process of manufacture of sulphuric acid is another example.

As regards heterogeneous catalysis, the best known case is the action of platinum on combustible mixtures of gases. Originally, the interest of this phenomenon centred in mixtures of hydrogen and oxygen; but there was not much industrial scope in this direction, which is now practically represented by the so-called self-ignition of lighting gas. Industrially, the interest has passed to the combustion of sulphur dioxide to trioxide. This is a very slow reaction, without the acceleration of catalysis. What catalytic-platinum does is to hurry it up; for which action various explanations have been offered. Professor Breding has represented the mechanism of such an acceleration by means of a fluid medium in which small masses of another fluid are suspended. If this suspended fluid reacts more energetically than the enveloping fluid, the portions of the reagents residing there will be the first to undergo change. The products will diffuse into the enveloping fluid; and thus the chain of operations will be started. Breding has demonstrated the manifold and energetic catalytic actions which are possible with colloidal platinum and other colloidal metals prepared by him.

There is a whole class of catalytic actions which cannot be considered here, as they belong to the realm of organic chemistry, which is concerned with the conversion of starch into sugar by means of acid. The end of this vista is physiological chemistry. There is enough to discover for the students of inorganic chemistry, and of the various applications of chemical science which are concerned with the processes of the gas manufacturing industry, in the catalytic influences which abound on all sides in these departments. The last great triumph of German technical industry, the synthesis of indigo, which may revolutionize the agricultural conditions of whole continents, contains as an essential factor a new catalysis. The oxidation of naphthalene by means of sulphuric acid can only be brought about expeditiously in the presence of mercury. It is hardly necessary to say that the sulphuric acid itself, whether produced by the old or the new method, is a catalytic preparation, When it is considered that the acceleration of a reaction by catalysis is achieved without consumption of energy, and so costs nothing, while the time saved represents money, it is easy to perceive that systematic utilization of catalytic appliances and processes is likely to lead to the most thorough-going changes of manufacturing processes.

In gas manufacture, it is difficult to say how much catalytic action enters into the ordinary processes of gas generation, condensation, purification, and the deposition of fluid and solid residuals. As regards naphthalene deposits in particular, it may be suspected that reference to this phenomenon may explain some otherwise mysterious action. The performance of the Welsbach incandescent mantle has likewise been named as possibly a case of catalysis. This may well be, as otherwise there is no theory known to science for the effect of the addition of 1 per cent. of cerium to the thorium which constitutes 99 per cent. of the dipping solution. At any rate, as Professor Ostwald remarks, the study of catalysis, which has only lately been seriously taken up, is a very promising one, and is charged with vast potentialities in regard to technical applications; while its theories point straight into the inner arcana of Nature's workings.

THE KITSON LAMP AND ELECTRIC LIGHTING.

There has of late been considerable controversy over the Kitson incandescent oil-lamp; but when all the facts are calmly considered by a disinterested outsider, it is abundantly clear that, at the bottom of all the senseless hubbub, are the jealous opponents of the light, and these opponents are, as a rule, found to be in some way mixed up with the electric light—either as dependents or as local advocates who allow their zeal for electricity to outrun discretion. Discretion, in fact, is a quality of which local administrations often seem to be sadly deficient; and this is one of the deplorable effects of the possession of a lavish spending power and of faddists wriggling themselves into positions in which they lead and rule in the local Councils. This Kitson lamp controversy is a case in point. The electrical people naturally look upon this cheap form of high-power illumination with great disfavour; and its competition is anything but welcome to them. Their position is perfectly intelligible; but it is certainly most unfair to place the lamp under their judgment and care. The position of the local councillor who opposes the lamp in favour of electricity is not so clear, seeing that the very purpose for which he is placed in authority is to defend the interests of the ratepayers, and to obtain for them the best value for their money. But it is evident from the treatment meted out in places to the Kitson lamp that the "best value" for the ratepayers is not always the controlling factor; and as the generality of ratepayers know little about these things, they simply allow themselves, as a rule, to be led by the man with the most eloquent tongue.

It is a pity that those who find the money not only for the maintenance of good order and condition in their districts but to gratify the whims and fancies of some of their local leaders, cannot have brought to their knowledge such lectures as that which Professor Vivian B. Lewes last delivered at the Petroleum Institute, and which was reported in our issue for the 22nd ult. They would there learn something about the means by which the best value in public lighting can be obtained; and such knowledge would enable them to abash some of the lay electrical know-alls. To be in a position to advance, on the authority of Professor Lewes, the statement that the cost of 1000 candles of illumination an hour by electric arc lamps is $3\frac{3}{4}$d., by high-pressure incandescent gas-lamps $1\frac{3}{4}$d., and by the Kitson incandescent

THE KITSON LAMPS IN PORTLAND PLACE.

oil-lamps 1d., would, we feel convinced, do something towards restraining the wasteful expenditure of local money. These figures, ratepayers might also be told, do not stand without the confirmation of practical experience. The costs derived from many installations of the Kitson system, for example—costs given by users who have no interest in the lamp beyond the effect that it has in giving an excellent return for their expenditure—are available for the mere asking. We cannot mention all of them, but we are satisfied that they not only confirm what Professor Lewes says, but they go further—they prove that the larger the installation, the lower the cost, and in some cases we find a fraction is knocked off the 1d. which he has given. Even a Gas Engineer—Mr. E. E. J. Anderson—when at Ripon, with an installation of four lamps in that city, reported that the actual cost worked out to 0·701d. per lamp per hour; and the Borough Surveyor of Folkestone acknowledges that the cost of obtaining 1000 candles per hour, with only three lamps running, does not exceed 1·3d. This is a small installation, and the price is high in comparison with other experience. But the figure, nevertheless, is valuable, coming from a man who, in all probability, was prepossessed in favour of some other form of illumination. Even if we place his price of 1·3d. in comparison with Professor Lewes's 3¾d. for electric arc lamps, what a saving is found! Another point that is made use of by the opponents of the lamp is that it requires attention. So do electric arc lamps; and as with the arc lamps, so with the Kitson lamp, the cost of labour decreases with the extent of installation. The figures given cover the expense of attendance; and others which may be obtained prove the assertion as to the diminution in cost with increase of number. Confronted by such testimony and facts, it appears downright puerility to waste time in trying to belittle the light from the cost point of view.

But leaving the question of cost for the moment, and looking again at recent controversy over the lamp, we find a peculiar state of things, and that is that, where trial installations of the lamp have been made, ratepayers are actually found petitioning for their retention, to the chagrin, no doubt, of the electrical enthusiasts on the local governing bodies. It will be remembered, for instance, that there was a trial installation put up in Portland Place in May last year. Now Portland Place is the residential quarter of several notabilities, prominent among whom are Earl Roberts and Prince Edward of Saxe-Weimar. The Marylebone Council had committed themselves to electric lighting; and the rumour reached the ears of the residents in Portland Place that the lights which they had been enjoying were to be sacrificed for the electric light. It must have been a bitter pill for the electricity smitten councillors when they received a petition, signed by 77 of these residents—the list including the names of some of the most honoured in the land—asking that these lamps might be retained. We give an illustration of Portland Place, showing the Kitson lights in the centre of the road. The picture also shows something else, and that is the miserable little gas-lamps which were previously employed for the lighting of this London street, with its flanking of noble residences. We do not know what the Gas Company did in the way of trying to prevent the Local Council from committing themselves to an expenditure of many thousands of pounds in providing a light which, at its best, costs, according to Professor Lewes, 3¾d. per 1000 candles, as compared with 2¼d. for incandescent gas-lamps, and 1¾d. for high-pressure incandescent gas-lamps. But if the Gas Company did not do anything the Kitson Company did; and the day may come when their offer will be brought before the councillors again to their confusion. The offer was to light the whole of the 65 miles of streets, and to take in payment exactly what was charged for gas lighting. Better, from our point of view, that gas should have been ousted from the streets by the Kitson incandescent oil-lamps than by electricity. But in connection with this offer of the Kitson Company, we may point to the statement made in last week's "JOURNAL" as to what the Croydon Gas Company have decided to do. There the Company have knocked off the extra charge they have been making for incandescent gas-lamps; and these lamps and all future conversions will now only be charged for at the same price as the old flat-flame street-burners. It is to be hoped—more especially in view of the cheaper mantles now purchasable—that the fight against electric lighting and wasteful expenditure will be carried on in a much more undaunted manner than it has been hitherto. Gas companies who take pattern by the Kitson Company and the Croydon Gas Company (there may be several others) will not only be doing something to protect themselves, but they will befriend the ratepayers generally.

But to return to the point as to the favour which the Kitson lamp has won in places where it has been tried. Exactly what happened in Portland Place happened in Oxford and Cambridge Terraces, in the borough of Paddington. Several of the lamps were installed there; but because the Company would not accept for additional 1000-candle power lamps the same payment that was being made for ordinary flat-flame jets, the lighting was discontinued. A petition in favour of its reinstatement was sent to the Council, signed by no less than 195 residents. Union Street, Aberdeen, is also lighted by the lamps; and the Press and the people speak very highly of the result. There are several installations now scattered through the country, numbering in all about 5000 lamps; so that there ought to be no difficulty for anyone to find out exactly what is done by them. The whole of the number mentioned are not, of course, used for street lighting; but for that purpose there are several examples. The light has been very successful in finding entrance into large works in competition with the electric light; and in certain instances it has actually deposed that light. The Trinity Board, too, have taken a great interest in the system; and one or two small changes, which have been made to adapt it for lighthouse work, have added to the powerful results previously obtained. From a 2-inch mantle, and without a reflector, a light of 1350-candle power is said to have been realized.

There are other points in connection with the Kitson light—as to the evidence of safety, its penetrating power in foggy weather, and the new and successful method of electrical ignition—about which we could write, but cannot spare the space at present. Besides which this article is merely intended to show the position of the light among the systems of high-power illumination, and its usefulness in the fight against the undue favour accorded by local authorities to the electric light. The characteristics of the lamp are well known to those of our readers who have interested themselves in our previous references to it.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see p. 1212.)

BUSINESS on the Stock Exchange last week was a good deal handicapped by the 1st of May holiday falling in the middle of it; so that the volume of transactions was decidedly below the average.

But what mainly helped to keep things quiet was the very general reluctance to commit oneself far until at least the probable outcome of the peace negotiations should be a little more discernible. Although the tone of the markets improved towards the close, yet, on the whole, they were all flat, and prices in general show a reduction, except in the case of the Funds. There was a brisk demand in the Money Market until the old month closed, after which the inquiry relaxed, and by the end of the week the position was fairly easy. In the Gas Market, business was fitful and irregular. For the first half of the week, it was extremely quiet; so much so that on Tuesday only two small dealings were marked. But upon the reopening after the holiday, there was quite a brisk revival. Movements in price were unfavourable; and the few changes in quotation that were made were all in the downward direction, though slight in degree. The issues actually affected, however, have all been subject lately to some degree of weakness more or less; and it would be scarcely safe to infer from their condition that Gas stocks in general were on the down-grade. In Gaslight issues, the ordinary opened rather shaky at 94; and, after a little dealing, it gave way a point. On Friday it was offered more freely, and the price shrank still more, till on Saturday it dropped another point, and the closing mark was 93—the worst of the week. A moderate amount was done in the secured issues; and they too looked like dropping, but managed to get through without a fall. Little was done in South Metropolitan; and finding no support, it fell back a point. Nothing in Commercials was touched, except the debentures, which changed hands at good figures. Not a single transaction was marked in any one of the Suburban and Provincial group; and quotations were not varied. The Continental Companies were very quiet; and the only noteworthy feature in connection with them was the continued hostility to Union, which dropped a couple of points, and changed hands at 149. Among the remoter undertakings, the only one to attract attention was Cape Town, in which there were several dealings, instigated possibly by brighter prospects in that part of the world. In the Water Companies, there was no change beyond a small improvement in East London. The extraordinary decision of the Joint Committee upon the Government Bill places the market in a state of greater uncertainty than ever; and until the next move on the parliamentary chess-board is made, there is not likely to be much dealing.

The daily operations for the first half of the week were quite insignificant. On Wednesday, Gaslight ordinary fell 1. On Thursday, the Exchange was closed. On Friday, there was brisk dealing in Gaslights. South Metropolitan fell 1, and Union 2. In Water, East London rose 1. Saturday was quiet, and Gaslight ordinary fell 1.

PERSONAL.

At the annual meeting of the Workmen's Club of the Croydon Gas Company on Monday last week, Mr. W. J. Russell, who retired on the 31st of December last from the office of Secretary to the Company, and is now a Director, was presented with a handsome silver jug, subscribed for by the workmen of the Company, as a token of respect and esteem, and in recognition of his services for some years as Honorary Secretary and Trustee of the Workmen's Sick Fund.

Last Wednesday, the connection of Mr. George Winstanley with the gas undertaking of the Coventry Corporation ceased. Before leaving, Mr. A. L. Newbold made a presentation to him, on behalf of the officials and workmen, of an American oak roller-desk, having the following inscription: "Presented by the officials and workmen of the Coventry Corporation Gas Department to George Winstanley, Esq., on his retirement as Engineering Manager, as a mark of esteem and respect."

We learn that Mr. J. Holliday, the Engineer and Manager of the Sutton, Southcoates, and Drypool Gas Company, has been approached by Mr. Gibb, the General Manager of the North-Eastern Railway Company, with an invitation to inspect the various coal and oil gas works on the Company's system, and afterwards to advise, in the form of a report or otherwise, what arrangements are in his opinion necessary to enable the Company to secure the greatest possible economy and efficiency at the different works. The Railway Company possess twenty-one gas-works, varying in yearly production from 126 million cubic feet downwards.

The Leith Gas-Works are to be closed very soon—perhaps this month. It was probably a shadow cast before of this coming event, which was exemplified by an incident which took place in the Queen's Hotel the other evening. Mr. George Moffat, the Works Superintendent, has been employed at Leith for the long period of 42 years. He began work as a retort-man in 1860, was made day foreman in 1864, and general foreman in 1882. The workmen and the staff in the office resolved to present him with a testimonial of their respect; and contributions having come in very freely, they were able to procure a marble clock, with ornaments, and a Gladstone bag, together with a diamond brooch for Mrs. Moffat. The presentation was made by Mr. A. W. Walker, the Works Manager, who very highly praised Mr. Moffat for his good qualities and his application to duty. Mr. Moffat suitably acknowledged the gifts.

Mr. James Bell, Town Clerk and Solicitor to the Corporation of Leicester, and Clerk and Solicitor to the Derwent Valley Water Board, was last Thursday chosen, out of five selected candidates, to fill the position of Town Clerk of the City of London, rendered vacant by the death of Sir John Brodrick Monckton. The voting was by ballot; and the successful candidate polled 103 votes against 45 given to the next highest on the list. Mr. Bell is 36 years of age, and is the youngest Town Clerk the City has ever appointed. He is a man of exceptional ability, and has had a remarkable career. At the early age of 25, he obtained the position of Assistant Town Clerk of Birmingham, which he relinquished in September, 1894, to become Town Clerk of Leicester, which post he obtained in competition with 63 other applicants. That his worth was appreciated is shown by the fact of two additions being made to his salary, which brought it up to £1500 per annum; and his appointment, by consent, as Clerk to the Derwent Valley Water Board carried with it a further increase of £400. The salary he will receive in his new position—the "blue ribbon" of his profession, which he has won in two removes—will be £2000 per annum. We heartily congratulate Mr. Bell upon his success, and trust he may be spared for many years to exercise his remarkable gifts in upholding the liberties and privileges of the ancient City of which he is now an officer. It may also be permissible to express gratification at the fact that the City Fathers recognized the advisability of securing the services of a young man for the important position they had to fill; for the oldest of the selected candidates was only 47.

It is not often that we have to chronicle the election of an Engineer of a Gas Company as Chairman of the Council of the district in which their operations are carried on, and therefore it is with all the more pleasure that we do so in the case of Mr. John Andrews, J.P., the Manager of the Langley Mill and Heanor Gas Company, who has lately been chosen to fill the above-named position. Mr. Andrews was elected on the old Local Board, as representative of the Langley Mill Ward, about seven years ago; and twelve months later he went into the new District Council at the head of the poll. At the two subsequent elections, he was returned unopposed. He was Vice-Chairman for six years, and Chairman of the Finance Committee for the same period. In the latter capacity, he rendered great service to the district. He has served on the Highway and Sanitary Committees, and is a member of the Water Committee and of the Ilkeston and Heanor Joint Water Board. It may be truthfully said that Mr. Andrews owes his position entirely to his own perseverance, having at the early age of nine to leave school and take a place in his father's workshop. He entered the gas profession on attaining his majority, and was engaged at the Radford works of the Nottingham Corporation. He obtained his present appointment in 1890; and since he has held it, he has developed the undertaking very considerably, as is shown by the increase in the output of gas from 13¾ to 29½ million cubic feet, notwithstanding the loss of several large consumers, who have adopted the electric light. Concurrently with this growth, the price has been reduced 1s. per 1000 cubic feet. This development has necessarily called for extensions of plant; and the result has been that the works have been practically rebuilt, and made equal to present and prospective requirements.

The Junior Engineers' Society and Masonry.—For a long time past, many of the members of the Junior Engineers' Society have had it in contemplation to form a Masonic Lodge restricted to members of the Society; and the Consecration Meeting was held at the Westminster Palace Hotel on Monday of last week—the number of the Lodge on the Grand Roll being 2913. The list of founders and first officers contains several names identified with the gas industry—among others, those of Bro. Samuel Cutler, jun., who has been elected Treasurer of the Lodge, and Bro. Walter T. Dunn, the Secretary of the Gas Institute, who is Junior Warden. Bro. W. J. Child, P.P.G.Std. Br. Essex, is also included in the list of founders. That the Lodge is destined to a successful career, is evidenced by the fact that already fifty members of the Society have entered in their names as wishful of being initiated into masonry.

Gas Power for Mining Districts.—This is the subject of an article by Mr. Hawley Pettibone, in the current number of "Cassier's Magazine." He points out that gas-power outfits for mining and smelting plants operate to the best advantage under the following conditions: When fuel cost is high; when wood, or bituminous or anthracite coal is the fuel; and when water is scarce or of poor quality for steam-raising purposes. With plants of 250-horse power or more, under every-day working conditions, one brake horse power per hour is produced with from 1·25 to 1·5 lbs. of bituminous or anthracite coal, or with 3 lbs. of wood. The consumption of water need not exceed 2 lbs. per brake horse power per hour. The steam from a good boiler plant represents about 70 per cent. of the heat developed by the combustion of the coal, and a good steam-engine has a total efficiency of about 10 per cent. The gas from a power plant contains over 80 per cent. of the heat in the coal, and a gas-engine has a total efficiency of 20 per cent. The results mentioned with steam are obtained only with the largest and best mining power plants; the general practice being 4·5 to 8 lbs. of coal per brake horse power per hour. The amount of saving effected with a gas installation, by being able to get along with so small a quantity of water, or with water of an inferior quality, cannot be stated definitely, as the conditions vary widely in different localities. A gas-power plant using wood for fuel shows the same ratio of saving as with coal; from 2 to 2·25 lbs. of wood being equal to 1 lb. of coal.

TECHNICAL RECORD.

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

Visit to Southport.

Last Saturday the members of this Association paid a visit to Southport, where, through the courtesy of Mr. John Booth, the Corporation Gas Engineer and Manager, they had an opportunity of inspecting the gas-works. The party were received at the works by Mr. Booth, Mr. Walmsley (the Assistant Engineer), and several members of the staff, and spent about two hours in going through the various departments and examining the machinery and plant. The works were pretty fully described by Mr. Booth in a paper read at the meeting of the Manchester Institution at Southport some eighteen months ago; * but since then important additions to the plant have been made in the shape of stoking and coke-handling appliances. The stoking machinery, which was introduced in September last, consists of two drawing and two charging machines worked by compressed air, and it has given very satisfactory results. The coke-handling plant has only been at work about a month. The coke is conveyed in barrows to the elevator, and then delivered into a screen, whence it is conveyed to the hoppers, which will hold between 200 and 300 tons of coke, and from which carts and waggons can be readily loaded. The power for this apparatus is supplied by a Crossley gas-engine. Both the stoking machinery and the coke-conveying plant were supplied by West's Gas Improvement Company, Limited. In passing through the works, the members were struck with the quantity of up-to-date machinery and plant which had been put down, and the good order which prevailed throughout. It may be mentioned that the consumption of gas last year over the area supplied from the works was about 420 million cubic feet. The present standard of illuminating power is 20 candles; but, as our readers are aware, a Provisional Order has been obtained from the Local Government Board sanctioning a reduction to 16 candles. Through the courtesy of Mr. Reginald S. Downe, the Electrical Engineer to the Corporation, the members were also enabled to inspect the electricity station, which is close to the gas-works, and where a 1000-horse power engine has just been erected.

At the close of the visits, the members were entertained to tea by Mr. Booth at the Queen's Hotel.

Mr. C. BERRY (Hyde), who, in the unavoidable absence of the President, occupied the chair, said that before they separated he would like to express the pleasure it had given him, to have the opportunity of inspecting what he might safely term a modern gas-works. They had also been allowed to go through one of the neatest electricity generating stations he had come across.

Mr. R. H. GARLICK (Salford) proposed a vote of thanks to Mr. Booth, Mr. Walmsley, and the staff, for the cordial manner in which they had received the members of the Association and conducted them through the works. The "JOURNAL OF GAS LIGHTING" had taken up the question as to what the senior members of the gas industry were doing for the benefit of the younger members; and their own Association had passed a resolution with a view of raising a discussion on the matter in the columns of that paper. He ventured to say they had in Mr. Booth, who had so courteously shown them round his works, and answered any questions put to him, a man who would support anything the Senior Associations might do for the well-being of the junior members of the profession. They wanted from these Associations the benefit of their experience. The Council of the Association were again taking up the question, with the view of once more setting the ball rolling.

Mr. TAGG (Birkenhead), in seconding the motion, said they—the juniors—were very greatly indebted to the senior members of the profession for any sympathy and support they gave them, as it would tend to bring forward a class of men more capable than they would otherwise have been of fulfilling the important positions in connection with the gas-works of the country. They all greatly appreciated the trouble taken by Mr. Booth and his assistants.

Mr. STODDART emphasized the necessity of the seniors taking an interest in the welfare of the junior members of the profession. If they would open their works and give them the benefit of their experience in some such manner as Mr. Booth had done, the juniors would in the near future be able to present themselves for positions, and fill them in such a way as to be a credit both to themselves and those who had supported them.

Mr. BOOTH, in responding, said it was with the very greatest pleasure that he and his assistants had received the members of the Association. They had at Southport gas-works of which they were proud. It had always been a point with him to keep abreast of the times. Whenever a new thing had suggested itself to him as likely to prove advantageous, he had named it to his Committee, and obtained from them instructions to go and see it in actual operation, and report upon it; and he could say, without hesitation, that in the case of all the modern plant they had seen that day—such as the carburetted water-gas plant, the Peebles oil-gas plant, &c.—when he had given his report upon it, his Committee had unanimously supported his recommendations. He was glad to know that the members had learned something by their visit. He did not see why a single works should be closed against any of them; and he trusted that this was not the case. They had much greater facilities and opportunities for fitting themselves for the higher positions in the profession than were enjoyed by the juniors when he was young; and if they went on in the way they were going, there was no question that they would make progress. With regard to the visit to the electricity works, he might say that when he mentioned to the Electrical Engineer that a number of junior gas engineers were coming to visit the gas-works, he very readily gave permission for them to inspect the electricity works also.

*See "JOURNAL," Vol. LXXVI., p. 1329.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by correspondents.*]

Photometry and Chronographs.

SIR,—My attention having been drawn to the discussion in your paper about the accuracy of minute clocks, I beg to state my experience in the matter. Residing in a watch-making centre, and being official gas examiner, the subject is interesting to me.

The Corporation of Coventry purchased a minute clock from Messrs. Alexander Wright and Co., for use with their photometer. That clock I submitted to Mr. W. N. Barber, the Chief Instructor of the Municipal Technical Horological School, and Examiner under the City and Guilds of London Institute. Tested against the standard clock on several occasions, the rate was zero. Thus it is possible to obtain reliable minute clocks; and your correspondent must have been unfortunate in his experience, which can by no means be taken as general.

J. H. BELCHER, Principal of the Coventry Municipal Technical Institute.

Coventry, May 1, 1902.

The Incandescent Mantle Settlement.

SIR,—My attention has been called to your article, "Incandescent Mantle Settlement," in which you give the whole credit to Mr. Livesey; and this gives great dissatisfaction to the incandescent mantle trade. So much so that I have my doubts as to whether the trade generally will fall into line, owing to this premature publication; and I have been asked by the trade to enlighten you as to the position.

In March of last year, I approached the late Board of the Welsbach Company with a view to putting an end to all litigation. I proposed working under license. I had many interviews, but failed. Letters appeared in the public Press as to the advisability of adopting such a policy; and the memorable meeting of Welsbach shareholders took place. A Committee was formed. Immediately this was done I again approached with my proposals, and was invited to put the matter before the Committee, which I did. I found it an almost impossible task, as both sides, plaintiffs and defendants, were not disposed to make the first advance. So I decided to approach all as an *intermediary*. I enclose copy of my proposals, which are not for publication. I had interviews with all the defendants and their solicitors; and, encouraged, I made Mr. Livesey acquainted with the position. As a result, I am pleased to say he invited me to see the solicitors; and I was then enabled to bring the litigants together, with a result that so far two of the actions are settled. Unfortunately, however, this does not settle the whole; and the premature announcement has caused, I regret to say, a hitch in the proceedings.

I am pleased to see that Mr. Livesey has been instrumental in bringing about a partial settlement; yet the litigants who are yet to be settled with feel it was made possible partly by their action in accepting my proposals, and they consider it was due to the action I took in getting both sides in a humour to treat.

I was not desirous of making the part I took known; but as the premature disclosure has caused friction which may yet be disastrous, I feel it my duty, in the hope that the facts being known, I may yet be able to renew negotiations, and be in the happy position to report to you that the trade dispute is satisfactorily settled all round.

D. EDWARDS-RADCLYFFE.

May 3, 1902.

Carburetted Water Gas as an Enricher.—Mr. Glasgow yesterday forwarded a reply to the letter from Mr. H. E. Jones on this subject which appeared in our "Correspondence" columns last Tuesday. As, however, the letter deals very largely with arguments based upon Mr. Jones's paper read before the Institution of Gas Engineers last week, it was thought better to incorporate it with the discussion on the paper, and consequently it appears on p. 1194 of this issue.

Water Storage at Oswaldtwistle.—Some time ago, the Urban District Council of Oswaldtwistle proposed to promote a Bill for various schemes, including the construction of a reservoir at a cost of about £26,000. A public meeting was called to consider the matter; but, owing to the opposition excited, the Bill was not proceeded with. At a recent Local Government Board inquiry, it was shown that a satisfactory supply of water could be obtained at a cost of only £3440, as compared with the £26,000 in the proposed Bill. The former sum, should the Local Government Board give their sanction to the borrowing of the money, will be expended in the improvement of what is now known as the residuum reservoir, and which, up to the present, has been useless owing to its incomplete condition.

PARLIAMENTARY INTELLIGENCE.

GLEANINGS FROM THE COMMITTEE ROOMS.

RAILWAY and tramway projects (electrical and otherwise) and local authority measures continue to rule in Committee proceedings. This is a lean year for gas experts in Parliament; water engineers are in better case; but electric and traction engineers, and railway and tramway experts, appear to be simply rollicking among the golden sheaves of a glorious harvest. The little town of Chard furnished us with our only Gas Bill last week; and two Water Bills (leaving out of consideration here the big London Water Bill) summed up the measures in that line which require attention. All three Bills, it will be seen, have their interesting features.

A Purchase Clause for Chard. The Chard Gas Company's Bill has nothing about it of a very intricate nature; but still it would have been better had it been submitted to a Committee who had some knowledge of gas legislation. Mr. Fison's Committee heard, on behalf of the Bill, the most luminous of leaders at the Parliamentary Bar (Mr. Balfour Browne, K.C.), and then Mr. Corbet Woodall and Mr. A. J. Edwards, the Managing-Director of the Company. On the opposite side (the Corporation were the only opponents), they heard the clear-speeched Mr. Honoratus Lloyd and Mr. W. A. M'Intosh Valon, as well as the Mayor (Mr. F. H. Mitchell), the last-named of whom—sensible of his high and responsible position as Mayor of the Borough of Chard and of the grave and ponderous questions involved in the Gas Company's application for parliamentary powers—came primed, judging by the bulk of his papers, with sufficient evidence to have kept, had he been permitted to unburthen himself, the Committee and Counsel going for several hours and perhaps days. But withal, in the end, the Committee delivered their decision with such perspicuity that Mr. Erskine Pollock, K.C. (for the Company), Mr. Lloyd, and others had to put their heads together, and politely interrogate the Chairman to ascertain exactly where they were and what the Committee meant. In the end, they succeeded in divining the Committee's intentions; but on clauses, even after conference, the parties had again to come into conflict before things were smoothed out to a level of satisfactory clearness. The Company are a non-statutory one; and they have just arrived at that position when new plant is required and consequently more money, in order to meet the increasing business, and to bring about improved conditions of working. Advised by Messrs. Corbet Woodall and Son, the Company determined to put themselves under statutory powers; and so they introduced the present Bill. They asked for new capital to the extent of £16,500, bringing up the total to £30,000, with borrowing powers in the proportion of one-third. They also, among other things, desired to come under the sliding scale, with an initial price of 4s. 2d. per 1000 cubic feet within the borough, and 4s. 7d. outside. The Corporation opposed first on the ground that the effect of passing the Bill would deprive the Corporation of the right to compete with the Company if necessity demanded. But, as Mr. Balfour Browne pointed out, the Corporation could not compete without the sanction of the Local Government Board; and the Board have never yet given a local authority the right to compete with a non-statutory company. Then the Corporation desired that a purchase clause should be inserted in the Bill; but it transpired that, while the ratepayers had consented to the opposition to the Bill, they had not had the question of purchase submitted to them. It was also contended that the amount of expenditure the Company sought to capitalize was excessive, and that the new capital asked for was beyond the necessities of the case. The standard price was also regarded as too high, in view of the fact that the Company allow varying discounts which bring the price in some cases down to 3s. 9d. The Committee's decision, put in plain terms, was that the preamble of the Bill was proved, but that a purchase clause should be inserted, its operation to extend only to the next session of Parliament. For this merciful consideration on the part of the Committee, the Company should be truly thankful; for there is nothing more hampering to a gas company than to live in a state of uncertainty as to whether or not they are to remain in possession of their works. The Committee also gave the Company the standard price asked for, but they wished a clause to be drafted (how it was to be done they did not know) so that the discounts should be continued and the shareholders derive no benefit from them in the way of an increase of dividend. This was a peculiar position, and a difficult one for even the astute Counsel engaged to surmount. It seemed at one time that the efforts to explain to the Committee that their object would be fairly and better effected by establishing a neutral zone would be of no avail. But ultimately a little light penetrated the confusion; and the Committee allowed the parties until the following day to look into the question of clauses. Then they accepted a clause (which, however, did not square with the views of the Corporation) defining a neutral zone between 3s. 11d. and 4s. 2d. within the borough, and between 4s. 4d. and 4s. 7d. outside. The purchase clause was also inserted, with a provision that the Company should not, without the consent of the Corporation, raise more than £6000 before Jan. 1, 1904. This also was not in accord with the views of the opponents; but they had to give way to the Committee. This was rather a nasty knock for the Corporation, if, as we believe, they could have settled a lower figure outside the Committee room. Therefore, on the whole, the Company came off far better than looked likely at the time the ambiguous decision of the Committee was delivered. Of course, it is needless to tell readers of the "JOURNAL" that there is no real importance, from the parliamentary point of view, in the compulsory insertion of a purchase clause in a Bill promoted by a non-statutory company. It has been done before, and will no doubt be done again.

Rickmansworth Gas Bill. The Rickmansworth Gas Company's Bill is passing through the House of Lords unopposed. The District Council had lodged a petition against it; but, through failure to comply with the Borough Funds Act, they withdrew. Consequently, there may be a contest in the Lower House.

A Big Water Amalgamation, and Supply in Bulk. Lord Pirbright's Committee have had before them the Bill of the Weardale and Shildon Water Company, which contains proposals of great magnitude. Primarily the measure is to enable the promoters to construct additional works, and to sanction the amalgamation of the Company with the Consett Water Company. The combined capital of the undertaking will be above a million pounds; and the area of their operations will extend over nearly half the county of Durham. The Sunderland and South Shields Water Company were the only petitioners before the Committee; and the object of their opposition was to get the insertion of an addendum to one of the clauses. This was the clause giving the promoters power to supply, by agreement, in bulk to any local authority, company, or persons beyond the limits of supply, provided "such supply shall not be given except with the consent of any authority, company, or persons supplying water under parliamentary authority at the date of the agreement." The petitioners asked for an addendum to this clause, providing that nothing in the Act should authorize the promoters to supply water in the statutory district of the Sunderland Company, without the consent in writing of that Company, except in regard to the past and future supply to the North Eastern Railway Company, which should be subject to such terms as might be agreed between the two Companies, or, failing agreement, as should be settled by an arbitrator. The reason for the Sunderland Company's alarm is disclosed by their petition. In or about 1898, the promoting Company supplied water at Durham or Leamside to the North-Eastern Railway Company for the purpose of its being carried through the petitioners' district for many miles. As a result, the income of the petitioners, they allege, was reduced by about £800 a year. Although the supply in bulk, under the clause in question, was not to be given without the consent of the Company having parliamentary authority to supply water in the district, the petitioners submitted that the clause might lead to expensive litigation between the promoters and the petitioners. It was objected on behalf of the former that the suggested addendum would be altering the general law of the country, and that, if any question did arise, the parties could go to the Law Courts to obtain its settlement. The Committee cut matters short and obviated further contention by rejecting the addendum, and then striking out the offending clause. The Bill proceeds with this excision.

A Fight for a Park. There is a big tussle in progress over a park before the Commons Committee, of which Mr. Bill is Chairman. It is in connection with the Omnibus Bill of the Liverpool Corporation; and there is quite a host of opponents legally represented. The clause which has raised the severest hostility is the one in which the Corporation seek power to acquire some 6000 acres of land in the Rivington reservoirs drainage area (where they already own 4000 acres), for the purpose of protecting the purity of the water supply. The proposal is very right and proper. But the unfortunate and rather threatening feature about it is that the land includes 400 acres generously presented to Bolton by Mr. W. H. Lever for a park; and naturally, the site having many advantages as a place of resort and recreation, Bolton is loth to part with its possession. Bolton holds that the use of the land as a public park would cause no detriment to the water-works of the Liverpool Corporation, but, on the contrary, would tend to improve the supply of water by preventing buildings, and also by the cessation of all farming operations. But experts, on the other hand, regard the establishment of a pleasure ground, to which thousands of people would have access, in the vicinity of one of the reservoirs (which covers some 275 acres) as a serious menace to the purity of the water; and so Liverpool are quite prepared to spend several thousands of pounds on the protection of the supply. On both sides of this unfortunate point, one could write and appeal with all the strength inspired by a good cause. But the real question is which is the greater necessity—the park or the protection of the water supply of a great community? We have no hesitation in saying that the balance of opinion of disinterested persons would be on the side of the latter. Mr. Balfour Browne, K.C., opened the case on this part of the Bill; and, at the second day's sitting, Mr. Claude Baggallay, K.C., continued it. Alderman Burgess, the Chairman of the Liverpool Corporation Water Committee, gave evidence, and Sir Henry Littlejohn, Professor and Medical Officer of Health of Edinburgh, added the weight of his testimony. The hearing is to be continued to-day; and the result will be awaited with curiosity—particularly by water engineers who, for the most part, hold very pronounced views on this question of water drainage areas being maintained absolutely in a condition above suspicion.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills brought from the Commons, read the first time, and referred to the Examiners: Leyland and Farington Gas Bill, South Metropolitan Gas Bill.

Bills presented, read the first time, and referred to the Examiners: Gas Orders Confirmation Bill (No. 1), Water Orders Confirmation Bill (No. 1).

Bill read a second time and committed: Kent Water Bill.

Bills reported: Bromley Gas Bill, Grand Junction Water Bill, Higham Ferrers and Rushden Water Board Bill, Reading Gas Bill, Shepton Mallet Gas Bill.

Bills reported, with amendments: Bradford Corporation Bill, Bradford-on-Avon Gas Bill, Bristol Water Bill, Buxton Urban District Council Bill, North Warwickshire Water Bill.

Bills read the third time and passed: Abertillery Urban District Council Bill, Buxton Urban District Council Bill, Longwood Gas Bill, Newcastle and Gateshead Water Bill, Rickmansworth Gas Bill, Shepton Mallet Gas Bill.

Bills Royal Assented: Finedon Urban District Water Bill, Hamilton Gas Provisional Order Confirmation Bill.

The Kent Water Preservation Association have presented a petition against the Kent Water Bill.

HOUSE OF COMMONS.

Tuesday, April 29.

WEST MIDDLESEX WATER COMPANY'S CHARGES.

Mr. WEIR asked the President of the Local Government Board whether he was aware that the West Middlesex Water Company had quite recently increased their charges to consumers; and, seeing that a Bill for dealing with the London Water Supply was before Parliament, whether he would state if any other Metropolitan Water Companies had also raised their charges since the introduction of that Bill, and, if so, give their names.

Mr. LONG: I am informed that from Christmas last the Company referred to have reduced the rebate which since 1884 they have allowed on water charges from 10 to 5 per cent. The alteration is stated to have been rendered necessary owing to the payment the Company have to make to the City Chamberlain under their Act of 1894, and to increased rates and charges for labour and materials. Notice of the alteration was sent to the Local Authorities in the district on the 1st of November, and an explanation is printed on all the application papers. I am not aware whether any other of the Metropolitan Water Companies have recently raised their charges.

Thursday, May 1.

LONDON WATER-RATES

Mr. KIMBER (Wandsworth) asked the President of the Local Government Board whether he would propose the insertion in the London Water Bill of clauses to readjust the existing water-rates, and to charge them on uniform principles throughout London, so that the charge for water should be such as to prevent any deficiency in the water fund which might be a burden upon the rates. He also wished to know whether provisions for securing uniformity of valuation for assessment similar to those contained in the Valuation (Metropolis) Act, 1869, applicable to the district outside the County of London affected by the Bill, would be inserted, and whether he would propose provisions for the supply of water by meter compulsorily if required by consumers.

Mr. GRANT LAWSON, replying in the absence of Mr. Long, said that such matters as the re-adjustment of water-rates or the supply by meter must be left to the consideration of the Water Board. A proposal would, however, be made before the Joint Committee to insert a provision in the Bill to the effect that the Board should not, until otherwise authorized by Parliament, reduce the rates charged for the supply of water below those in force during the present quarter. An amendment of the law so as to secure uniformity of valuation for assessment would be one of the main objects of the proposed Government Valuation Bill, and would be outside the scope of the Water Bill.

The following further progress has been made with Bills:—

Bills brought from the Lords, read the first time, and referred to the Examiners: Abertillery Urban District Council Bill, Longwood Gas Bill, Newcastle and Gateshead Water Bill, Rickmansworth Gas Bill, Swindon United Gas Bill, West Hampshire Water Bill.

Bill presented, read the first time, and referred to the Examiners: Local Government Board Provisional Order (Gas) Bill.

Bill read a second time and committed: Street Urban District Council Water Bill [Lords].

Bills reported, with amendments: Bedford Corporation Water Bill, Chard Gas Bill, Knaresborough Improvement Bill, West Gloucestershire Water Bill.

Bills read the third time and passed: Birkenhead Corporation Bill, Birmingham Corporation Water Bill [Lords], Bournemouth Gas and Water Bill, Darley Dale Water Bill [Lords], Leyland and Farington Gas Bill, South Metropolitan Gas Bill, Wrexham Water Bill [Lords].

HOUSE OF COMMONS COMMITTEE.

Tuesday, April 29.

(*Before Mr.* F. W. FISON, *Chairman, Mr.* C. MORLEY, *Mr.* STRUTT, *and Mr.* THOMAS O'DONNELL.)

CHARD GAS BILL.

This Bill, which was for the purpose of incorporating and conferring powers on the Chard Gas Company, came before the above-named Committee to-day.

Mr. BALFOUR BROWNE, K.C., Mr. ERSKINE POLLOCK, K.C., and Mr. VESEY KNOX appeared for the promoters; Mr. HONORATUS LLOYD and Dr. HERBERT SMITH represented the Chard Corporation.

Mr. BALFOUR BROWNE, in opening the case, gave a brief history of the undertaking from 1870, when the Company was incorporated under the Companies Acts; and gas was supplied by them and their tenants and by a Mr. Wheatley and his successors, Messrs. Boden. He pointed out that the total expenditure of the Company on capital account down to December, 1891, was £12,101. Under the Bill, the capital of the Company would be £30,000, the sliding-scale would be adopted, and the standard price would be fixed at 4s. 2d. and 4s. 7d. per 1000 cubic feet. The petition of the Chard Corporation stated, among other things, that the effect of passing the Bill would be to deprive them of the right of supplying gas within the borough, and thus relieve the Company of possible competition. He defied his learned friend to show a single case where a local authority had been allowed to enter into competition with a non-statutory company. There was not one.

Mr. LLOYD: Because they get the right of purchase put into the Bill.

Mr. BALFOUR BROWNE said there was no Bill in the case of a non-statutory company. The Corporation had no right to compete with the Gas Company, unless they got leave of the Local Government Board; and the Local Government Board had never given a local authority a right to compete with a non-statutory company. The Corporation said they believed that the existence of a power to compete would act as an incentive to the Company to study the public requirements, and would constitute a more useful check upon the Company than the statutory obligations proposed to be imposed upon them by the Bill. It was about fifty years too late to talk about competition in gas. It was never allowed, and did not exist anywhere. The petitioners also complained in their petition as follows: "Your petitioners further complain that the Bill contains no provisions enabling them to acquire the Company's undertaking. It is submitted that where the town is deprived of the possibility of competition, as is proposed by the Bill, facilities should be given to the local authority to acquire the undertaking upon fair and reasonable terms, and that the Bill should not be allowed to pass into law unless it contained provisions to that effect." He joined issue with the petitioners there absolutely. If they came in the right way to Parliament with a Bill of their own, he thought Parliament would consider the whole question whether the Company should be purchased by the Local Authority or not. But that was not what they were doing. If they came for a Bill of their own, they would have to get the sanction of the ratepayers to it; and this was a most salutary check. Merely putting in a petition asking for a purchase clause, was going behind the backs of the ratepayers. They were seeking to get a Bill through Parliament for purchase without having one before the House themselves. Exactly the same point was raised only three or four days ago before a Committee presided over by Lord Stanmore. Huddersfield came upon the Longwood Gas Company's Bill, and said "Give us a purchase clause;" and Lord Stanmore decided that he would not allow Huddersfield to go into the matter. He (Mr. Balfour Browne) asked the present Committee to do exactly the same thing here. There had been no resolution of the Chard Corporation that they should purchase.

Dr. SMITH said there had been a resolution of the Corporation.

Mr. BALFOUR BROWNE said that at any rate the subject had not been mentioned at the meeting of the ratepayers. Purchase was outside the inquiry; and he asked the Committee not to allow the petitioners to go into it. On every other point he was not only prepared to meet them, but invited the fullest discussion. They did not want to do anything detrimental to the consumers of gas in Chard, but only to place themselves into a position of safety under certain restrictions—having been advised by Mr. Corbet Woodall to obtain statutory powers.

Mr. *A. J. Edwards*, Managing Director of the Company, gave evidence in support of the Bill. He explained the progress of the Company, down to the present time, and submitted that they could not get on without further manufacturing plant, and that they must have more capital to enlarge their works.

In cross-examination, witness affirmed that there was probability of the demand for gas in Chard increasing. Notwithstanding a loss of 1,000,000 cubic feet through bad trade in the collar factories, the supply had increased. By the Bill, the consumers would obtain considerable additional protection.

Mr. *Corbet Woodall* said he had visited and inspected the Chard Gas-Works. Private gas manufacturers had been bought out, and the competition had been absolutely abandoned. The growth of the gas business had been 6¾ per cent. during the past ten years. The share capital of the Company was £12,000, and there was £3000 of borrowed money. The rate of capital to the business done was about £800 per million cubic feet, which was not a high amount for works of this size. Further expenditure was necessary in the immediate future. With increasing business, there was need to increase the works. As a non-statutory Company, the promoters at present were under no obligation to supply gas—they could charge any amount they pleased, and divide any sum of money as dividend. But, on the other hand, they had no right to open up the roads. Companies ought to be compelled to put themselves under statutory authority in these matters. The Bill proposed that the standard price of gas should be 4s. 2d. per 1000 cubic feet within the borough, and 4s. 7d. outside, which was very reasonable. With regard to the contention of the Corporation, as to their competing, the Local Government Board, to the best of his recollection, had a rule under which they would not allow the transfer of a non-statutory company without an application for an Act. The Company were content to carry on their business. If the Corporation desired to purchase, let them come to Parliament with a Bill.

The CHAIRMAN: If this clause were inserted, the Corporation need not come to Parliament; they could exercise the power of purchase under the clause.

Witness: Under the Public Health Act.

Under the clause?—I think not. That is why I mentioned the rule of the Local Government Board. Whether or not the clause is in, if the Corporation wish to purchase, they will have to come to Parliament. The clause would be that, in the event of the Corporation applying next year or the year after for a Bill to purchase, the Company shall not oppose the preamble but only the clauses, with a view to proper protection.

Mr. POLLOCK: That presupposes an application to Parliament?

Witness: Yes.

Do you think that, commercially, it hampers the activity of a gas company to have a purchase clause hanging over its head?—I do.

But there is an arbitration clause?—Yes. But the expenditure on extensions is for some time to come, and therefore is unproductive to some extent; and they are burdened with a capital not represented by a proportionate amount of profit. In these clauses, there is a limitation as to period. Five years would be a very long period.

Wednesday, April 30.

On the resumption of the proceedings to-day, the case for the promoters was closed.

Mr. LLOYD then addressed the Committee on behalf of the Corporation of Chard. He said the Gas Company occupied the position of gas-mongers, having no statutory rights; and they now asked that statutory rights might be given them. The state of affairs was often before Parliament, and the question always assumed an acute form with regard to the matter of purchase. If the Bill were passed, the Corporation

would be deprived of the right they now had to supply themselves; and the established practice of Parliament in such cases was to insert a purchase clause if the local authority gave an undertaking to come to Parliament the next session. It was also the custom in such cases to provide that the increased powers of the Company should not enhance the value of the undertaking in event of purchase. He thought the amount of capital the Company were seeking to have established could not be justified. They asked to have the sum of £6000 as "A" stock, £1500 which they say would be spent out of revenue, as "B" stock, and £13,500 to be set up and established as their old original capital. Every farthing expended on the undertaking was therefore to be set up as original capital, however wasteful the expenditure might have been, and without showing the value of the works to day. He should establish, by the evidence of Mr. Valon, that the value of the works was £8556. The price of gas to-day was 4s. 2d. per 1000 cubic feet, with a discount; and the average price at which the Company sold gas was 3s. 9d. They asked 10 per cent. upon the £6000, and 5 per cent. upon the other two sums. If the Company dropped the discount and sold the gas at 3s. 9d., they could declare a dividend of 11¼ per cent. The storage accommodation was only one-third of what was required, and there were various other shortages. Counsel then read a form of purchase clause, which he asked should be inserted, similar to that in the Menstone Water-Works Act of 1899.

Mr. *W. A. M'Intosh Valon* was then examined in support of the case of the Corporation. He said that the Company's works had come to the end of their tether. Having described the condition of the works, he said a good portion of them must be cleared away and new works erected, which meant, of course, that, in addition to the money which the Company were seeking to capitalize, £5000 or £6000 would be required to put the works in proper order. He handed in the following detailed valuation: Works and plant £4333, land £1193, mains and services £2035, meters £553, and gas cooking-stoves £442 —£8556 in all. The amount of capital asked for the future was excessive, as the expansion of Chard was very limited. The standard price asked for, of 4s. 2d. per 1000 cubic feet, was a very high one. The Company had only been paying 8 per cent. in the past; and they had been paid by starving the works. If the works had not required to have this £5000 spent on them, the capital might have been reasonable. There was no trace of how the £12,000 had been expended. It would be suicidal for the Company to extend their mains to Combe St. Nicholas. It would reduce the profit, and increase the price in Chard itself. The power to supply electricity asked for in the Bill should not be taken out of the hands of the local authority. He thought that a fair amount of capital, having regard to the requirements of the Company for the next twelve years (supposing the works to be put into proper order), would be £6000 share capital, £2000 loan capital, and £10,000 for capital expenditure—£18,000 altogether.

Mr. *F. H. Mitchell*, Mayor of Chard, produced a resolution passed by his Corporation with regard to the Bill, on April 3, in favour of the insertion of a purchase clause. The first information the Corporation got of the introduction of the Bill was seeing the advertisement in the local paper. He did not get a copy of the Bill until the 23rd of December. The ratepayers' meeting was practically unanimous in opposition to the measure.

In cross-examination, witness said that, at the time of the ratepayers' meeting, the question of purchase was not before them. The resolution passed by the Corporation on the 3rd of April had not been confirmed by the ratepayers.

In re-examination, witness said if the Committee passed the Bill, he was anxious for the insertion of a purchase clause; and that was the position of the town as a whole.

By the CHAIRMAN: They wanted the power of purchase; and he most decidedly thought it should be put into force.

This closed the case for the petitioners.

Mr. POLLOCK then addressed the Committee in reply, contending that the Company in raising capital had not tried to put large sums as dividends into their own pockets, but had raised it in the most economical way. In regard to the insertion of a purchase clause, it rested with the Committee in each particular case to decide upon the circumstances.

After the Committee had deliberated in private,

The CHAIRMAN said: The Committee have come to the conclusion that the preamble of the Bill is proved. They think that a purchase clause in favour of the Corporation should be inserted, and that the Corporation should apply next session, and should carry out the purchase without delay. The Committee are of opinion that no clause should be put in which would give the Corporation power to purchase without their carrying it into effect. If they wish to purchase the Company, they must do so as speedily as possible. The only other point is in regard to the standard price. On the sliding-scale, as the Committee understand, the authorized standard price is taken at 4s. 2d. per 1000 cubic feet. They do not think that this should be reduced to the present net selling price of 3s. 9d., nor that the Company should so get the benefit of the 5d. in increasing their dividend, but that the clauses must so run that 4s. 2d. is a real sum, and that is the actual basis on which the authorized standard price is taken.

In reply to Mr. LLOYD, the CHAIRMAN said the Committee had decided that the clause was to be a non-enhancement one—the Corporation to purchase on the present conditions. In regard to the standard price, the Committee wanted the Company to keep the 4s. 2d., but not for the Company to say after that was passed, "Now we will charge you 3s. 9d.," and so take the credit for the 5d. in the dividend. Their intention was quite clear, that the ordinary shareholders should have 10 per cent.; the Committee did not want to give them 11¼ per cent.

Thursday, May 1.

The Committee sat to-day to consider the clauses of the Bill, and, with reference to clause 58, fixing the standard price.

Mr. POLLOCK said he had brought up a clause, in accordance with the promise he had given to the Committee, establishing a neutral zone in regard to additional dividend. A fair neutral zone would be one of 3d.—between 4s. 2d. and 3s. 11d. As the clause stood at present, the standard price was fixed at 4s. 2d. within, and 4s. 7d. outside the borough. The proviso he suggested was as follows: "Provided that no increased dividend beyond the statutory rate of dividend shall be paid in respect of any year in the course of which the price charged to any consumer shall have exceeded, inside the borough 3s. 11d. per 1000 cubic feet and 4s. 4d. per 1000 cubic feet outside the borough." The Corporation, however, were not satisfied with that. They wanted a neutral zone of 5d.; but inasmuch as the promoters had done their best, he hoped the Committee would adopt their suggestion.

The Committee passed clause 58, with the addition of the proviso as brought up.

The only other clause discussed was the purchase clause.

Mr. POLLOCK said it was not argued that the Company must have unlimited power to go on spending money; but they must have some money to go on with, as there were matters which could not be delayed. The Company said they must have power to spend £6000; and they were willing to say that, if they wanted more, it should only be with the Corporation's consent. There was evidence that this sum would be spent at once.

Mr. LLOYD said he could not go so far as that. He was prepared to agree to this clause so far: "The Company shall not, except with the consent of the Corporation, raise any capital in pursuance of this Act prior to Nov. 20, 1902; and if the Corporation shall give notice of such Bill as aforesaid in October or November, the Company shall not raise any capital during the promotion of such Bill in pursuance of this Act. But the Company may borrow any money not exceeding ——." The Corporation would thus have to give notice of their Bill before the 20th of November of this year. It was therefore only a question of a few months. It was reasonable that what the Company owed to their bankers should be repaid; and he thought £2500 would be sufficient in all.

Mr. *Woodall*, on behalf of the promoters, said the Company must be responsible for the supply of gas for two winters—this and the next. They had no capital, and were in debt to their bankers. In his opinion, they ought to be at liberty to proceed at once with the building of the gasholders to use next winter, the cost of which would be £4000. In addition to this, there was £1500 owing to the bankers, and the cost of the promotion of the present Bill, and the cost of service-laying and pipes. If this sum were not granted, the Company would not be able to take on additional consumers; and he might fairly say the value of the undertaking, when the matter came to arbitration, would be much depreciated.

In cross-examination, witness said if an undertaking were not equal to dealing with the business the profits of which were being purchased by arbitration, then an allowance would have to be made for deficiency of works, and the cost of bringing the undertaking up to the proper standard. If the Company, however, were allowed to raise the money and put the undertaking in order, then the allowance would still have to be made. There was not a particle of difference if the expenditure were properly made; the only difference was that if the Company were not allowed to do this, they would get into disrepute, and the most would be made of that before the arbitrator. The main object was to enable the Company to deal with their present business, as they had only 40 per cent. of the storage they ought to have.

Mr. *Valon* was re-called by the Corporation. He said that if the Corporation purchased the works—of which he had no doubt—they desired to lay them out in accordance with their own ideas. It was the Company's own fault that they were in their present position; and they were seeking to get out of it at the expense of the Corporation. With this £6000, they could construct works with a view of at once increasing their income, so that the value of the undertaking would be improved when it came before the arbitrators, and put into a position with which fault could not be found. He suggested that the £1000 beyond the £1500 owing—£2500 in all—would enable the Company to tide over the winter in peace and comfort.

The CHAIRMAN said the Committee were quite unanimous in allowing the Company to raise £6000. For public convenience, it was quite reasonable.

It was therefore agreed that the purchase clause should conclude: "The Company shall not, without the consent of the Corporation, raise more than £6000, either by the issue of additional capital or by mortgage, before the 1st of January, 1904."

The remaining clauses were gone through, and the Bill ordered to be reported.

Drought in East Kent.—The drought experienced in East Kent is causing much concern. At Hythe the town's water supply has fallen off so alarmingly that the Corporation have made arrangements with Folkestone for an increased quantity for five years.

Lambeth Water-Works Company.—The Directors of this Company have decided, subject to audit, to recommend the payment of a dividend on the 10 and 7½ per cent. stock, for the past half year, at the prescribed rates, with the addition of 1 per cent. per annum on account of deficiencies of previous dividends; leaving a balance of about £1800 to be carried forward, after making provision for the statutory payment to the Chamberlain's sinking fund.

New Water Supply for Bewdley.—A new water supply for the ancient borough of Bewdley was inaugurated last Wednesday. It has been carried out by Mr. R. E. W. Berrington, Assoc.M.Inst.C.E., of Wolverhampton, at a cost of about £12,000. The well, from which an abundant yield of water has been secured, is near the River Severn at Blackstone, and the site has been granted on easy terms by the Rev. Slade Baker Penoyre, a large landowner. The new pumping-station, which was opened by the Mayor (Mr. T. Owens), in the presence of a large gathering, contains four oil-engines, Mr. Penoyre objecting to steam; and the exigencies of the locality require two reservoirs—one to supply the lower, and the other the higher parts of the town. The water is pumped direct from the wells to the reservoirs. After the opening ceremony, Mr. Berrington made a statement respecting the work, and complimented Mr. Reading, of Wolverhampton, the Contractor, upon its execution. He also presented a silver cup to the Mayor as a memento of the occasion. The reservoirs were afterwards visited.

JOINT PARLIAMENTARY COMMITTEE ON THE LONDON WATER BILL.

Fifth Day—Monday, April 28.

On the opening of the proceedings to-day,

Mr. *J. T. Taylor*, the Town Clerk of Harrogate, examined by Mr. PEMBER, gave the history of the transfer of the Harrogate Water-Works to the Corporation in 1897. The award, which amounted to £187,000, was given on Dec. 31, 1897; and the actual transfer took place, when the money was paid, on the 13th of May following. During the period intervening, the Company carried on the undertaking in the same way as theretofore.

Mr. *W. B. Bryan*, Engineer to the East London Water Company, examined by Mr. RIGG, said he had never found any difficulty in arbitrations conducted under the Lands Clauses Act. He thought that if new officials of the Water Board—many of them ignorant of the conduct of water-works undertakings—attempted to carry out the business of the Companies as from an appointed day, it would not be a successful operation.

Mr. RAM said he did not propose to cross-examine witness.

Mr. *J. W. Restler*, Engineer to the Southwark and Vauxhall Company, said that engineers could not do their duty, in preparing cases for arbitration on behalf of their respective Companies, if they were transferred to the Water Board before the arbitration took place.

Mr. *Walter Hunter*, Engineer to the Grand Junction Company and Joint Engineer of the Staines Reservoirs, examined by Mr. LITTLER, said that the proposed transfer before arbitration would certainly entail delay. It was assumed that, if there were no appointed day, there would be delays on the part of the Companies; but that he regarded as fallacious. Directly the Bill was passed, there would be few or no dealings with the Companies' accounts until the Arbitrators made their award. In the case of shareholders compelled to realize, and in the case of those who might wish to dispose of their shares, the transition period would necessarily impose a disability to sell, except at a considerable sacrifice; and that made it desirable that the transition period should be as short as possible. There would be no inducement for the Companies to delay; but, on the other hand, once the undertakings were transferred, there would be no inducement to the Water Board to complete the arbitrations. Security should be given to the Companies that the proceedings should be taken in hand as quickly as possible. No security could be better than that the undertakings should not pass until the money value was paid.

Mr. LITTLER: If the accounts are declared to be closed at a fixed date—say, June, 1904—and after that date the undertakings shall be carried on by the Companies on behalf of the Water Board, would that be a sensible way?

Witness: I think so.

Will there be any necessity for any large expenditure of capital?—No; except that already arranged. I am anxious to show to the Committee that there is no need for hurried procedure. Last year was a very dry one; and many cities and towns in the North of England suffered from shortness of water. Owing to the intercommunication scheme, which has been partly carried out by the Companies at the instance of the late General Scott, the Water Examiner, not a single hours' intermission of supply occurred in London. The works will be completed this summer; and unless the sources of supply should themselves fail—which is, one might say, absolutely impossible—it will be physically impossible for anyone in Water London to suffer from want of water.

Then with regard to the immediate future?—The lines upon which the supply of all the Thames and Lea Companies will be maintained will be settled for many years to come by the powers granted to the Companies by Parliament under the Staines Reservoirs scheme.

With regard to the Welsh scheme. We will not go into what was reported by Lord Llandaff's Commission; but are you prepared to show at the arbitration that the supply sanctioned by Parliament has postponed the necessity for the commencement of an extraneous source of supply for at least thirty years?—Yes.

You are also of opinion that it will save London something like £20,000,000?—Yes.

The Water Board will have ample employment for its energies in developing works already constructed, or in course of construction?—Certainly; and I think that, by the experience so gained, they will be better capable of judging what additional sources of supply may ultimately become necessary.

What do you say to the principal officers of the vendors being transferred to the purchasers before the inquiries have taken place?—The suggested procedure by the Companies, of transfer on payment, would have the great advantage of preventing the unjust and unprecedented arrangement contemplated under the Bill, whereby the principal officers of the seller will become the salaried officers of the purchasers before their service has been completed, to which, from long association and upon the ground of moral right, the Companies have the prior claim. It would be impossible for the officers to serve two masters in the way suggested, and to do justice to the Companies and the Water Board alike in preparing their cases for hearing.

Supposing an engineer had given evidence as to an undertaking being of greater value than the amount which the Arbitrators afterwards awarded, would that place him in an invidious position?—Yes. I can illustrate that by a practical instance. I acted as the Arbitrator appointed by a Water Company in the sale of its undertaking to a Corporation. There was an ultimate difference between myself and the Arbitrator appointed by the Corporation of about £9000. The Umpire, an eminent and fair-minded Engineer, awarded a sum about midway between those arrived at by the two Arbitrators. Considering my figures after the award was made, I am still convinced that my valuation was a fair one, and borne out by the evidence, with the exception, perhaps, of a sum of £1700, which might be subject to argument. I desire the Committee to picture to themselves my unhappy position with regard to the Corporation if I had been, at the time of arriving at my figures, a salaried officer of that body; and I ask the Committee to save me and my fellow-Engineers rom such a position.

In reply to further questions, witness said a shareholder possessing £1000 in any small water company was invariably granted the Lands Clauses Act arbitration free and unfettered. While he felt that the works of his Company were in an excellent condition, he was at the present time engaged in a special examination of them for the purpose of carrying out any special repairs or renewals which were necessary, in order that they might be transferred to the new authority in a state equally satisfactory to the Water Board and creditable alike to the Company and to the Engineer responsible for their condition. Special provision had been made for the future.

Mr. RAM (in cross-examination): You have said that if the procedure under the Bill were followed, the Water Board might delay. Can you indicate to the Committee why you think they would delay?

Witness: There would be no inducement to them to come to a conclusion and pay over the value to the Companies. We should have parted with our works. There might be unavoidable delay. I do not mean there would be any wish to delay; but it puts the Board in the position that it does not matter to them at all whether the Companies are transferred within a year or within twenty years.

You are aware that the Board will pay interest to the Companies until the money is paid?—Yes.

The Staines Reservoirs are owned by the West Middlesex, Grand Junction, and New River Companies. Suppose the procedure was to take place without an appointed day, and the arbitration (say, with regard to the West Middlesex Company) was concluded and the award made, the share of the West Middlesex Company would be taken over by the Board?—Yes.

The Board would then be in the position of being part-owner with two Companies whose cases have not been heard. Do you think that is a convenient arrangement?—I do not think it matters a bit.

This concluded the evidence on this part of the Bill (clauses 1 to 18), with the exception of 7 and 8.

Mr. LITTLER then addressed the Committee on behalf of the Companies he represented. He said the promoters had been unable to produce one single instance, out of the dozens of cases of transfers, where the Lands Clauses Act had caused the slightest injustice. The only excuse for the present proposal was the magnitude of the case. But, presumably, the greater the undertaking the more cautious one should be in regard to it. The Companies were simply victims of the fad that the water supply must be in the hands of a public body. They were called upon to surrender their property, because it was said to be in the public interest; and under these circumstances, they were entitled to the most respectful consideration which Parliament could give them. The whole of the part of the Bill with which they were dealing seemed against all the practice and business principles of everything which had been done in the past, simply because a new and unknown experiment was being tried without any possible safeguards for it. He would not trouble the Committee with regard to the financial provisions.

The CHAIRMAN asked if he had any objection to them.

Mr. LITTLER said he had no special objection which he could bring out as a main feature; and at present he was confining himself entirely to the main features. Clause 18 was full of innovations of the most dangerous description. It was an absolute novelty for the promoters, who were acting on behalf of the purchasers, to dictate to the vendor absolutely what the whole of the provisions should be. A special tribunal was appointed; and the clause deprived that tribunal of all the safeguards provided in arbitrations. The Companies objected to the tribunal appointed—some for one reason, and some for another. Why should they not appoint an Arbitrator, and the Water Board do the same; and the two Arbitrators appoint an Umpire? There could not then be any complaint. It was the most blundersome Bill ever brought before Parliament—and he was aware that was saying a great deal. Then two Commissioners could act without the third. The Court of Appeal could not sit without there were three Judges present, and might be only dealing with £100; while the Commissioners were dealing with millions. Again, if a misrepresentation had been made by some of the parties by which an error was made in the award, there was no provision for setting the decision aside, however important. Surely the power ought to exist.

Mr. BAGGALLAY and Mr. PEMBER also criticized the provisions of the Bill; the latter stating that the whole intention was to handicap the vendors, so as to prevent them getting the full value of their undertakings. All the provisions which were different to those of the Lands Clauses Act were, he said, against the vendor; and everything was done to safeguard the purchaser from the consequences of a procedure which had been shown to be simple, and one of common sense and justice.

Mr. FITZGERALD, in reply, dealt exhaustively with the three main objections to that part of the Bill—the appointed day and the arbitration provisions—raised by the Companies, and the payment in water stock, raised by the London County Council. The arguments he urged were those which had already been raised in the course of the proceedings, by evidence and otherwise. With regard to the appointed day, he said the promoters were willing to extend it from June 24, 1904, to Dec. 25, 1904, in order to meet some of the objections raised before the Committee. It was quite possible that two of the arbitrations—and even three, though he doubted that—might be concluded before that date. If the special tribunal were appointed, some of the matters in dispute would then probably become narrowed down. The provisions of the Lands Clauses Act, he submitted, were never intended to apply to such a case as the present. They provided for valuation by a Jury; and for arbitration only as an alternative. No one outside a lunatic asylum would say that the present was a case for a Jury. The Companies had been quite unable to show that the Arbitrators would not be able to give the full value of the undertaking to the Companies under the provisions of the Bill. He was willing that the Lord Chief Justice should appoint a successor to a Commissioner, if necessary, instead of the Local Government Board, which body had no desire to retain the power in their hands.

At the conclusion of the speeches, the Committee deliberated in private. On the public being readmitted,

The CHAIRMAN said: The Committee adhere to the principle of the appointed day—that is, a definite day beyond which the last transfer of a Company must not be delayed—and to transference, if necessary,

taking place before payment. But if hereafter they are satisfied that a slight extension of the time named in the Act as the last possible date for the appointed day would mitigate inconvenience, or would make it probable that, on other matters attaching to that particular point, the Bill would become an agreed Bill, the Committee will listen to a proposal for such extension of time when they come to the clause which deals with it. On the question of the water stock, the Committee desire to reserve their decision as to whether payment shall be compulsorily in water stock, or whether an option shall be given to any Company to take payment in cash, until they come to it in going through the clauses of the Bill, for the purposes of hearing some further arguments, and possibly of asking for some further information. With regard to the conditions of arbitration, the Committee adhere to the framework of the Bill, to the special Court, to the prohibition of 10 per cent. for compulsory purchase, and generally to the provisions of the Bill But they are of opinion that any casual vacancy in the Court of Arbitration might well be filled by the High Court, and not by the Local Government Board. Possibly the provisions for delegation of power require some revision; and the Committee will leave them to be tendered in the sense in which Mr. Fitzgerald explained the matter to them. There may be some question, when we come to clauses, as to sub section 7 of clause 18, regarding the method by which cases may go to the Court of Appeal; but that will be reserved till we reach the point in the clauses.

A discussion as to procedure followed.

The CHAIRMAN presumed the constitution of the Water Board would be the next question taken up, and that it would be a matter between the London County Council and the promoters.

Mr. FREEMAN (for the London County Council) said it was exceedingly difficult for them to criticize the constitution of the Board, which they considered the most vital part of the Bill, until they knew the exact position which was going to be taken up by the outside authorities. It might make an immense difference if a number of outside authorities satisfied the Committee that they ought to be excluded from the undertaking altogether, as they would then have to discuss the constitution of the Board on a different footing. They asked the Committee to say that the outside authorities should be heard first, and then the London County Council. By the outside authorities, he meant Middlesex, Hertfordshire, and Kent.

Mr. WEDDERBURN (for the Kent County Council) said his case would be so short that nobody could rely upon it. His real case came up on clauses 7 and 8.

After further discussion, it was agreed that Mr. Fitzgerald should bring forward evidence as to the constitution of the Board, and that the opponents should proceed as convenient.

Sixth Day—Tuesday, April 29.

On resuming the inquiry this morning,

Mr. RAM said the promoters would call one witness with regard to the proposed representation on the Water Board.

Mr. *Lithiby*, one of the Assistant-Secretaries to the Local Government Board, who had already given evidence, was recalled and examined by Mr. RAM. He said the Department had paid very careful attention to the constitution of the Water Board, and had had regard to all the suggestions which had been made in previous Bills. Special consideration had been given to the recommendation of Lord Llandaff's Commission. The authority proposed by them corresponded very closely with that contained in Lord James's Bill, introduced by the Government in 1896; but it appeared that the Commission put it forward rather as a suggestion than as a matter which they had definitely decided. Some time after the issue of their report, the Local Government Board received deputations from the London County Council on the general subject of the water question, and on March 21, 1901, a large number of members saw Mr. Long, when the Chairman of the Water Committee (Mr. M'Kinnon Wood) dealt particularly with the constitution of the proposed Board. In the course of his remarks, he said that the Royal Commission's recommendation was not of a scheme for representing the ratepayers throughout the water area, but for the creation of a paid Board, the Chairman and Vice-Chairman of which would be salaried nominees of a Government Department. These, and the six members appointed by the Thames and Lea Conservancies, would be non representative persons. Mr. Wood proceeded to state that the proposal differed from the other recommendations of the Commission, inasmuch as it was not based upon, or tested by, evidence. The point had been put to Mr. Halsey, the Chairman of the Surrey County Council, to Mr. Littler, the Chairman of the Middlesex County Council, to Mr. Bigwood, and to Lord Avebury, and none of them had advocated a Trust. Mr. Wood said he had raised the point in discussion in Committee, in debate in the Council, and in private conversations, and though he had found a good many who were of opinion that there should be a Trust for the whole water area, he had not found a single representative man who would commit himself to approval of the report of the Commission as regarded the authority. After careful consideration of these remarks, and of all the matters bearing upon the point, the Local Government Board decided that they would proceed on some basis upon which to form their Board other than that recommended by the Commission.

Mr. RAM: A recommendation was made by the Commission that the Water Board should be a permanent and not a fluctuating body?

Witness: Yes. That point was considered carefully, and some effect is given to it in the proposals of the Bill.

As to the suggestion that it should be permanent, did you have regard to the experience of large water undertakings other than those in London?—Yes. The experience of municipal corporations has shown that the management of large water undertakings can well be carried on by bodies which are not permanent in the sense in which I suppose the word was used by the Commission—not permanent officers. They remain for three years; and, of course, they may be re-elected.

Does that hold good with regard to Liverpool, Birmingham, Manchester, and several other large towns?—It does.

Examination continued: The point had also been present to his mind that in many cases Joint Boards had been elected where several authorities were interested, and these Boards had all worked well. Witness proceeded to name specific cases of successful joint working—viz., the Accrington District Gas and Water Board, the Ashton-under-Lyne, Stalybridge, and District Joint Water Committee, the Chesterfield Gas and Water Board, the Cockermouth and Workington Joint Committee, the Colwyn and Colwyn Bay Joint Water Supply Board, and the Derwent Valley Water Board. In addition, a large number of Joint Boards had been constituted for various sanitary purposes, such as Asylum Boards, Hospital Boards, Port Sanitary Authorities, and Sewerage Boards. Under the Isolation of Hospitals Acts, a number of Joint Boards were now being constituted by the county councils for isolating for infectious disease.

Mr. RAM: With regard to business capacity, on the Borough and Urban District Councils in and around London, there must be many men possessing the necessary qualifications.

Witness: Certainly. It is common knowledge that the members of the great municipal corporations manage their water undertakings; and, so far as I know, they had no special knowledge of the matter before they undertook the management.

In further examination, witness stated that the Local Government Board had borne in mind the suggestion made by Sir William Harcourt's Committee in 1880, when considering Lord Cross's Bill, as follows: "Your Committee are of opinion that it [the Water Authority] should compose elements derived from the Corporation of London and the Metropolitan Board of Works, together with a due representation of the districts at present supplied by the Metropolitan Water Companies which lie beyond the jurisdiction of the Corporation and the Metropolitan Board." Also, by the Act of 1897, the County Councils of Essex, Kent, Middlesex, and Surrey combined with the Metropolitan Authorities for the purpose of the Metropolitan Water Act, 1901; and by the London Government Act of 1899, powers with respect to water companies were given to each of the Metropolitan Borough Councils constituted under that Act.

Mr. RAM: Taking all these matters into consideration, did you ultimately select a scheme upon one basis of representation?

Witness: The scheme was selected, and the principles underlying it are representation to the Metropolitan Borough Councils, to the Urban District Councils in the water area outside London, to the County Councils who were Metropolitan Authorities under the Acts of 1871 and 1897, and to certain bodies which were regarded as representing the sources of supply. So far as the sanitary authorities of the Metropolis outside are concerned, the Bill follows the precedent of the Public Health Act, 1875—that is, the principle of managing undertakings and matters of joint concern in different sanitary authorities by Joint Committees appointed by those authorities. The principle is as old as the Act of 1848, and was continued in the Public Health Act, 1872. It is found again in its present form in the Public Health Act, 1875; it was adopted by Mr. Ritchie in the Local Government Act of 1888, and by Sir H. Fowler in the Local Government Act of 1894.

So far as the Metropolitan Borough Councils are concerned, were they also dealt with by the Public Health Act of 1891—the London Act?—Yes. By that Act they became sanitary authorities, and also by the London Government Act of 1899.

As contrasted with the Metropolitan Borough Councils, have the London County Council certain sanitary functions of a special nature different from those possessed by other county councils?—Yes; and this has been recognized in the Bill by giving more representation to the Council than they would have been entitled to merely regarded as the Metropolitan Authority. They also have powers under their 1892 Act; and this has been considered in apportioning their representation.

Was it difficult to ascertain precisely what representation should be given to each of the Borough Councils of London?—There was considerable difficulty, because the population and rateable value of the different Metropolitan Borough Councils, like those of the Urban District Councils, vary considerably. It was thought that to give one member to each Borough Council would probably not meet with their wishes; and, on the other hand, it was clear that any proportionate representation would add materially to the numbers of the Water Board. Therefore it was decided to see to what extent additional members could be given to the larger and the more populous Borough Councils. First a comparison was made according to their population, and secondly according to their rateable value; and putting the two together, the result was to bring out the first six in this order: Islington, Lambeth, St. Pancras, Westminster, Stepney, and Kensington. They were tested also in other ways by various combinations of population and rateable value; and this particular arrangement seems to have the balance of advantage. To these six it is proposed to give two representatives each; and one to each of the other Metropolitan Boroughs. By population and rateable value, West Ham, outside the county of London, is also entitled to be treated in a similar way. With regard to the Urban Councils outside London, it is impossible to give each a representative. There are a great number of them; but the population of most is considerably smaller than that of the Metropolitan Borough Councils.

In reply to further questions, witness stated that some of the petitioners urged that the Board was too large and unwieldy, while others desired to make it considerably larger. It was undoubtedly large. Yet more representatives were asked for by the Middlesex County Council; the Metropolitan Boroughs of Battersea, Hackney, Wandsworth, and Westminster; the Boroughs of Kingston and West Ham; the urban districts of Walthamstow, Beckenham, Bromley, Chislehurst, Twickenham, and Hornsey; the Conservators of the Rivers Thames and Lea; and by the rural districts of Bromley and Dartford. There would be several Committees appointed; and it was necessary to have a large number on the Board in order that they might carry out their duties without any undue burden.

In cross-examination by Mr. BLENNERHASSETT, on behalf of the City of Westminster, who directed attention to its large rateable value—viz., £5,500,000—witness said population was the chief factor considered by the Board, and rateable value the second. The population was 183,011. He did not say it was not reasonable for Westminster to ask for three representatives instead of two; but this was a matter for the Committee to decide.

In reply to Mr. BAGGALLAY, for the Thames Conservancy, witness said that, if the Committee thought it desirable to give that body

increased representation, the Local Government Board would not object.

In answer to Mr. WEDDERBURN, for the Kent authorities (who asked or a separate Water Board), witness admitted that to some extent the three Kent representatives would have different interests from the remaining members, inasmuch as the former would desire to maintain their wells for Kent. He dissented from the idea that this was a ground for severing the outside Kent authorities from the Board.

In reply to Lord ROBERT CECIL, for Middlesex and Hertfordshire, witness said the object was to have all the authorities represented.

It was intimated by Counsel that Middlesex and Hertfordshire did not wish to make any amendment to the proposed representation but if this were done, they desired to be heard against it. The same statement was made with regard to Essex.

In answer to the Hon. F. THESIGER, for the London County Council, witness said the principle was that, as the water supply was spread over a large area, it should be managed by a Joint Board constituted from the sanitary authorities of the area. This had been done in the Derwent Valley case, as well as in numbers of other instances. He admitted that there was a broad distinction between the central administration of the London County Council and the more purely local administration of the Borough Councils.

The CHAIRMAN said the Committee would like to know the suggestion of the London County Council as to the constitution of the authority to purchase and manage the water undertakings, as their petition was not very distinct.

Mr. THESIGER said the Council thought that if there was to be a Joint Board as proposed, the authorities to be represented ought to be the County Councils; and this was what they put forward. They would, however, prefer a smaller body, and some such arrangement as that embodied in Lord James's Bill of 1896.

The CHAIRMAN said it was obviously useless to ask the Committee whether they were going to add another representative to Westminster, and so on, if afterwards he had to put the question whether the whole schedule should not be swept away, and something put in its place. Therefore the case of the London County Council must be heard first. As, however, he believed some interests were present on the understanding that the Local Authorities' petitions were to be taken, they would be heard.

Sir *F. Dixon-Hartland*, M.P., Chairman of the Thames Conservancy Board, then gave evidence on behalf of that body. In reply to Mr. BAGGALLAY, he said he wished their representation to be increased from one to three. They represented the whole of the watershed of the Thames, which furnished 60 per cent. of the water supplied to London. He had seen Mr. Long, who authorized him to say that if the Committee chose to give extra representation to the Conservancy, the Government thought it would be a reasonable thing.

Mr. RICKARDS said the promotors would be willing to leave the matter to the Committee as far as two representatives were concerned; but they could not agree to three.

Mr. *E. J. Halsey*, Chairman of the Surrey County Council, gave the reasons of that body for desiring to appoint the whole of the three Surrey representatives instead of only one. They wished, he said, for complete severance; but, at any rate, they wanted to have the right to take water in bulk throughout.

In cross-examination by Mr. RICKARDS, witness said he was aware that severance had been condemned by the last Royal Commission, and therefore the Surrey County Council did not insist upon it.

Mr. BAGGALLAY then briefly addressed the Committee on behalf of the claim of the Thames Conservancy and the Surrey County Council, as put forward by the last two witnesses.

Mr. BELLEWES then obtained permission to call one witness on behalf of the City of Westminster.

Mr. *L. Woodhouse*, Comptroller to the City of Westminster, explained to the Committee why the increased representation from two to three was asked for. Their rateable value was £5,518,000, out of a total of £48,029,000 for Water London. This gave them a right to 6·3 members. Their population was 183,011 out of 5,898,940, which entitled them to 1·7 members. Adding these figures together gave eight members, and four if divided by half; while three only were asked for.

Mr. *T. M'Kinnon Wood*, Chairman of the Water Committee of the London County Council, was called in support of the petition of that body. In reply to Mr. FREEMAN, he said there were two main points to be considered in the constitution of a water authority—viz., administrative efficiency and representative character. The body proposed by the Bill fulfilled neither of these requirements. In the first place, it was a great deal too big for an administrative body which had only to manage a single service, and was much larger than had ever been proposed by any responsible authority in the past. Because there were a great number of Directors of each of the Water Companies, it did not follow that there should be a proportionate number on the Board. A business eight times as large did not necessitate eight times the number of managers. Corporations of other towns managed their water undertakings by a committee of moderate size, consisting of from ten to twenty members; and the London County Council in their proposal suggested that they should appoint a Statutory Committee to which they might delegate matters of management and administration, reserving to the Council itself the power of controlling capital expenditure. They took authority to appoint men not on the Council, including representatives from outside, if arrangements should be made with the outside areas to this effect. The Water Board proposed by the Bill was too heterogeneous to secure a coherent, consistent policy. It did not represent the interests of London or of the counties outside, but rather the conflicting interests of localities. The County Council looked at the matter from the point of view of the general interest, and discounted the local interest. The water question was to be looked at from the interests of the whole area of London, and not from those of parishes.

Mr. FREEMAN: Do you consider it another objection that the members are to be drawn from a very wide area?

Witness: Yes. That plan will create serious practical difficulties. On important questions the members will attend, but on every-day matters they will not. Consequently there will be a fluctuating body and a fluctuating policy. The members will have to be drawn from six counties and upwards of 600 square miles. If the attendance is fluctuating, the almost inevitable result will, I think, be that the real conduct of the business will fall into the hands of the officials.

In further examination, witness said London had the greatest conceivable interest in the efficient management of its water supply. The London ratepayer was interested directly, both from the public health and financial points of view. On every £1,000,000 raised, he would pay more than £850,000; and therefore he had an absolute right to an effective voice on the Board, both with regard to purchase and management; and under the proposed constitution he would not have that voice. There would be no "healthy test of direct contact with the electorate," as recommended by Mr. Ritchie when introducing the Local Government Act of 1888. It was quite impossible for the ratepayers to have effective control over the Board, who would have unlimited power of issuing precepts to make up deficiencies of water income, and of raising very large loans for which the chief security would be the rates. This was to be drawn upon by a body which was not representative of London. He thought the constitution of the Board violated the sound principles of local government and financial responsibility. The practical result would be that no authority outside London would have any real power whatever on the Water Board, as the members appointed would represent but a very small part of the electing authority. It could not enter into the policy of the Board, check its finance, or bring it to account in any way. The same principles applied to the London representation. Lord Llandaff's Commission proposed that London's representatives should be appointed from the London County Council; and in Lord James's Bill of 1896, the Council had 16 members out of 30. The present Bill gave them 10 members out of 69, and 34 members—the bulk of the London representation—to the Borough Councils. No real power was, however, given to these Councils, as when once their members had been elected their functions ceased. They could not criticize any item of expenditure. The proposal of the Bill based the representation of London exactly on the model of the old Metropolitan Board of Works, only the Water Board perhaps went farther in indirectness and remoteness from the electorate, because the Board of Works was at least confined to one local government area, and was less heterogeneous in its composition. The faults which existed in that body were due, in several cases, to inefficient control over the officers—too much being left to them; and there was no control by the electorate. It was the essence of representation that the representative could be called to account. Under the Bill there was no such power; and therefore the London ratepayer would have no effective control over the Board. The proposal was a direct reversal of the established system of the representation of London. The County Council took charge of general matters affecting London, while the Borough Councils dealt with those of an essentially local character. The Council was the principal health authority in London, and had large powers of administration and supervision; and he contended that such a body ought not to be divorced from the water supply. The representative interest in the entire undertaking, on rateable value, was as follows: London, 81·44 per cent.; Essex, 3·80 per cent.; Kent, 2·58 per cent.; Middlesex, 6·72 per cent.; Surrey, 2·34 per cent.; and West Ham, 3·12 per cent. According to population, London's interest would be equal to between 85 and 86 per cent. His three contentions were: First, that the Board failed in administrative efficiency; secondly, that it failed in representative character; and, thirdly, that it violated the present established system of administration in London. He supported his contention that representation should be otherwise provided on the authority of Lord Ridley's Committee of 1891, the Water Act of 1892, Lord James's Bill, and Lord Llandaff's Commission. He agreed with the suggestions there made, that the London representation should be provided by the County Council. He asked that this body should be the water authority for London. It was not desirable that representation should be given to the London boroughs. If the Committee considered that it should be given to the outside areas, then the principle of Lord James's Bill, of granting it to the county authorities, with a predominating voice to London, was far preferable to that of the present Bill. The recommendation of Lord Llandaff's Commission was also preferable.

Seventh Day—Wednesday, April 30.

At the commencement of to-day's proceedings,

Mr. BLENNERHASSETT made a strong protest, on behalf of the City of Westminster, against the views expressed by Mr. M'Kinnon Wood on the previous day on the matter of representation.

Mr. *M'Kinnon Wood* was then recalled, and cross-examined by Mr. RAM on behalf of the promoters. He said he suggested that the London County Council should be the Water Authority. This matter had been dealt with by Lord Llandaff's Commission; but he denied that it had been "amply" discussed. The Council were not, on that Commission, put in the position of arguing the question of a Trust. The Commission had come to the conclusion that the London County Council should not be the purchaser. If it were decided by the present Committee that there should be a Joint Board for the whole area, then he suggested that the Board proposed by Lord James, on behalf of the Government, in 1896, was very much preferable to the one now proposed. It was a smaller and much more workable body, and it represented the County Councils which really represented all the areas.

Mr. RAM: Do you recollect the suggestion made by Lord Llandaff's Commission: "We think the Board should be so constituted as not to give a preponderance to any of the conflicting interests concerned"?

Witness: Yes. That is not carried out in the present scheme.

How do you suggest it could be improved so as to lessen the preponderance to any one conflicting interest?—It is quite impossible, under the present scheme, to avoid putting everybody in a minority; but you do give a preponderance to London.

To put every body in a minority means that no body is in preponderance?—Yes.

Is that desirable?—Not if you do it so that no body has any power at all.

Which would be in such a position that they would be powerless?—Each Borough Council, each group of Urban District Councils, the County Councils outside London, and the London County Council.

You might have groups of these people, who are powerless in themselves, making a strong combination and forming a majority.

Is not that exactly what is suggested—that there should be no preponderance to any conflicting interest?—Yes; but it goes much further than the Commission. It has no power.

Your suggestion that you should get more representation for the London County Council can only be arrived at by eliminating the Borough Councils?—Yes.

The Borough Councils are not represented here because they are satisfied with their representation upon the Board. Those in favour have made representations to the Local Government Board as representing 2,500,000 people; while those who have opposed have made representations which affect 500,000 persons?—Every authority is naturally inclined to accept representation or anything.

Do you think these bodies, being absent, ought to be struck out without being heard?—I have no objection to their being heard.

Continuing, witness said that the County Council had come to the conclusion that severance for supply in bulk would not be disadvantageous to London. Increase of business did not mean increase of profits. He thought the effect of the Bill would be that the Chairman and Vice-Chairman, who were the paid members, would run the Board; and he objected to this when the Board was supposed to be representative.

The CHAIRMAN asked if the result of London obtaining the works and property of the Water Companies for supply in bulk would not be that County Council London would get all the rich part of the business, and leave that which was less good to the outside districts.

Witness said that would be so.

The CHAIRMAN: Do you not think we must regard Water London as the unit, and that it would be unprecedented to split that unit up, keeping the rich part in one hand and all the poorer portions in a variety of other hands?—I do not suggest that. We should give the County Councils the right of distribution, as they wish; but the obligation to supply the whole area should remain exactly as it does in the case of Manchester, Liverpool, Glasgow, and Edinburgh—in the hands of the central authority. If London receives autonomy, it must not refuse that autonomy to others.

What is the evidence that they desire to have it split in the way you suggest?—The evidence is the resolutions arrived at by the outside authorities. Our whole policy has been based on the findings of Lord Ridley's Committee, and practically on the result of the conference of 1891, which has been referred to. And the same thing happened in 1895 and 1897.

Mr. *H. L. Cripps*, Parliamentary Agent to the London County Council, in answer to Mr. BALFOUR BROWNE, said that he had acted in the conduct of parliamentary proceedings for the Metropolitan Board of Works, and subsequently for the Council since 1891. He had had charge of their case before the Royal Commissions presided over by Lord Balfour of Burleigh in 1892 and 1893 and by Lord Llandaff from 1897 to 1899. The Board proposed by the present Bill was contrary to all the lessons of experience. The experience of the last century had led up gradually to the adoption of the municipal system. One of the most important branches of Private Bill legislation for the last thirty years had been the gradual transfer of the undertakings of water companies to municipal bodies. It would require strong arguments to adopt a new system which had never been tried before. The finding of Lord Llandaff's Commission, that the purchasing authority should not be the London County Council, was based on the presumption that this body were pledged to severance and to the Welsh scheme. The Council, however, were not pledged to severance in any sense, though no doubt they thought that some such plan was a fair solution. As to the Welsh scheme, the proposed Board was almost directly calculated to bring about such a result.

The CHAIRMAN asked for some tolerably distinct indication of the positive proposal which was going to be put forward by the County Council.

Mr. BALFOUR BROWNE agreed that mere criticism was not what the Council desired. They were wedded to the municipal system; and if the Committee thought fit to report that the undertakings should be handed over to the Council, this was what they desired in the first place. If the Committee would not go so far as that, they infinitely preferred the body proposed by Lord James's Bill, which was a representative body on the county basis. Failing that, they preferred the body suggested by Lord Llandaff's Commission. They wanted, first, a much larger representation of the unit—the county; secondly, no representation of the boroughs, who were not water authorities, and were not constituted for that purpose at all; and, thirdly, representation of the outside districts (not districts so much as counties who were the same units as themselves, the Administrative County of London) very much on the lines of Lord James's Bill. If he were forced away from the municipal system, this was the body he would suggest.

The cross-examination of Mr. Cripps was then proceeded with. At its conclusion,

The CHAIRMAN said he had consulted the Committee privately, and they felt they were precluded from considering an amendment which would substitute the County Council for the schedule constituting the Board.

After a short adjournment,

Mr. BLENNERHASSETT said that, if evidence were to be given against the Borough Councils being represented, he would ask permission to call evidence in their favour on behalf of the City of Westminster.

Mr. J. D. FITZGERALD said that a number of other Metropolitan Borcughs had not petitioned against the Bill because they were satisfied with the representation given; and if the question were to be raised and their representation taken away, they would desire to call witnesses to say they wished to be represented.

The CHAIRMAN said he would take a note of that, and wait to find out exactly what issue the County Council brought forward.

Mr. BALFOUR BROWNE said it must have been known that the question to be discussed was the constitution of the Board, and that it was possible it might be altered; and therefore the Borough Councils had had full opportunity of giving evidence upon the point. In consequence of the Committee's decision, the constitution he put forward on behalf of the County Council was that proposed by Lord James's Bill in 1896. He admitted, with reluctance, that it was a choice of evils; but he proposed to give evidence that the basis proposed by Lord James's Bill was simpler, more workable, and better than that suggested by the present Bill.

Mr. *Shaw Lefevre*, in reply to Mr. BALFOUR BROWNE, said he had been at one time a member of the London County Council, and was for two years Chairman of the Improvements Committee. Leaving aside the question of the passing of the works into the hands of the Council, he had considered the proposal that they should pass into the hands of the Board proposed by the Bill. He thought the proposed constitution a very bad one. He had had considerable experience in dealing with the London Water Question. So long ago as 1871, he introduced into the House of Commons what he believed was the first Purchase Bill. The main object of that Bill was to get a constant supply of water to London. The Companies at the time objected to doing so; and it was considered that Parliament could not legislate on the subject without the consent of the Water Companies. He proposed to compel them to give a constant supply; and, as an alternative, purchase. The proposed Trust under the present scheme was very much on the lines of the Metropolitan Board of Works—providing indirect representation through the different authorities of London. He had considered the constitution which was proposed by Lord James's Bill, and thought it infinitely preferable to that now before the Committee. He would not say it was an ideal scheme; but it was the next best to the municipal system. The sources of supply for Water London were situated in those counties which would have representation.

In cross-examination by Mr. FITZGERALD, witness said that if a Board were constituted on which the London County Council had a majority, the other County Councils would not be more under the control of London than they would be under the Board proposed by the Bill. No doubt, the Council would have the majority on the Board, as proposed by Lord James's Bill; but under the proposal of the present Bill, London would have a larger proportion. He should imagine that the outside authorities would object to one or the other. Under Lord James's Bill, there was to be a Board of 31 members, 16 of whom were to be appointed by the County Council.

Mr. FITZGERALD: In consequence of that proposal, a meeting was held by the other County Councils, and they passed this resolution: "That it be respectfully intimated to Her Majesty's Government that, in the opinion of this conference, the interests of the County of London and each and all of the surrounding county authorities within what is called in the Bill the Metropolitan water area are so diverse as to make the constitution of a Water Board as proposed impracticable without injustice to the several areas contained therein." I take it it was in consequence of that that the Bill was not proceeded with?

Witness: That was one of the objections, no doubt.

You would like to see that constitution revived, and a majority on the Water Board given to the London County Council?—Yes.

In re-examination by Mr. BALFOUR BROWNE, witness said all those bodies at that time would have preferred to have autonomy. If they could not have it, the question was not before them whether they would choose this or that Trust. If the majority were not in the hands of the London County Council, that body would be under the predominance of those round about it; and this would not be right. There was one other objection he had to the proposal of the present Bill—viz., the payment of the Chairman and Vice Chairman. This would introduce an altogether new element.

Mr. *G. H. Turner*, member of the Hampstead Borough Council, gave evidence against the Bill.

Mr. *G. F. Deacon*, examined by the Hon. F. THESIGER, said he considered the proposed Water Board a great deal too large, and thought it would be unwieldy in practice. He should prefer 30 members at the outside. The Committee of Management in Liverpool numbered 20, and it included two representatives from the only place outside the limits of the city which was represented—the borough of Bootle. He did not consider the greater size of an undertaking necessarily involved a very much larger increase of the members of the Managing Committee. It would be almost impracticable, in the working of a water undertaking, to have local Committees appointed to receive complaints from the public, and deal with them, as had been suggested by Mr. Lithiby. The practice of the public going direct to the Committee was discouraged in every possible way in Liverpool. It was not desirable to have a basis of representation which included so many divergent interests. About 13 members represented the Committee of Management of the Derwent Valley Water Board, which was formed to manage the water supply of Derby, Leicester, Sheffield, and Nottingham, and the Local Authorities of the counties of Derby and Nottingham, covering a population of nearly 1¾ millions.

In cross-examination by Mr. RICKARDS, witness said that several Joint Boards for the supply of water in populous districts had been created in the past few years. He acknowledged that Liverpool, with its Committee of 20 members, dealt with a population of 900,000, while the proposed Water Board for London would deal with 6,330,000, and was to have only 69 members. Asked if this proportion was unreasonable, he said population had very little to do with the matter.

Mr. *Everett*, a member of the Fulham Borough Council, also gave evidence against the proposed Board.

Mr. BALFOUR BROWNE then addressed the Committee on behalf of the London County Council upon the question of the constitution of the Water Board. He said the Committee had full power to modify it in any way they pleased; and their whole object would be to get the best body they could to administer the water supply of London in the future. The one proposed by the Bill was not to be directly under the control of the ratepayers of Water London, and it was very large and unwieldy—much larger than either of the bodies recommended by Lord James's Bill and Lord Llandaff's Commission. It was a retrograde movement, re-establishing, for the purpose of managing the water supply of London, the Metropolitan Board of Works, which had been swept away with the approval of every body and every citizen in London. This was why the County Council advocated the constitution of a Trust such as was recommended by Lord James's Bill. He would not accept that constitution if the Committee had not ruled him out upon the municipal aspect of the case; but when driven from that, the next best basis to be adopted for the

constitution of the Water Board was a county basis. The county of London was governed by direct representatives, and had an enormous stake in the matter, and the other counties were also interested, and had more to do with the water supply than the Borough Councils of London. The latter were in an anomalous position. The Government thought it well to change their name from "Vestry" to "Borough Council," to try to get a higher class of gentlemen to take part in municipal affairs; but it never conferred upon them any rights or duties with regard to water supply or drainage. They were merely vestries in disguise. The whole object of the Bill seemed to be to put the power into the hands of the small boroughs, in order to take the power away from the great authority of London. It was true that, according to Lord James's Bill, the County Council would have the preponderating voice; but he submitted that they were entitled to it by population, and by the richness of their district for water supply. He asked the Committee to accept Lord James's Bill *en bloc*. Though in some things he did not like it, yet he did not want to alter it in any way.

Mr. WEDDERBURN (for Kent) said he should ask at a subsequent stage that Kent should be excepted from the Board, as being in an entirely different position, and having a right to special treatment.

The CHAIRMAN said any decision arrived at on the constitution of the Board would be subject to the question of Kent's representation.

Mr. *Andrew Johnson*, Chairman of the Essex County Council, was then called, and, in answer to Mr. GRUBBE, said his Council were contented with the representation allotted to them.

Mr. *George Corble*, called on behalf of the Lea Conservancy, of which he is Clerk, asked that two representatives instead of one should be given to that body.

Mr. RAY LANKESTER (Hertfordshire), Mr. MACKENZIE (Wimbledon), and Mr. MORTON (West Ham), stated that their respective clients were satisfied with their proposed representation.

Mr. BALFOUR BROWNE asked, on behalf of the Berkshire County Council, that they should have a representative, as they feared a time might come when the lower sources of supply might fail.

Mr. FITZGERALD replied on behalf of the promoters. In the course of his remarks, he said the London County Council asked to have the preponderating voice on the Board; but all the other authorities objected to this. He urged that the representation as proposed by the Bill should be agreed to.

The room was then cleared, and the Committee deliberated in private for nearly an hour. On the public being re-admitted,

The CHAIRMAN said: The Committee have, by a majority, decided to delete the representation of the Metropolitan Boroughs from Schedule 3. They also delete the representation of the urban districts and boroughs in the counties of Essex, Kent, Middlesex, and Surrey, other than the borough of West Ham. The promoters are requested to prepare a fresh schedule, on the scheme indicated by this decision, for a Water Board consisting of about 35 members, including a Chairman and a Vice-Chairman, but without giving a majority on the Board to the representatives of any one county.

Mr. RAY LANKESTER, on behalf of East Ham, said he had no idea there was any suggestion of its being excluded, or he would have addressed the Committee upon the point.

The CHAIRMAN said he was afraid he could do nothing in the matter after the Committee's decision.

Mr. RAM said the decision was one of far-reaching consequences; and he suggested an adjournment over the next day, in order to allow the President of the Local Government Board to consider the great change which had taken place in the Bill.

The CHAIRMAN refused the application; and the Committee adjourned till the following morning.

Eighth Day—Thursday, May 1.

The CHAIRMAN, after some discussion as to procedure, said that clauses 7 and 8 would be considered, and that the Committee were quite clear that the best course would be to hear the cases of all the opponents before giving any decision upon one.

Mr. WEDDERBURN asked whether the case on behalf of the Kent County Council and the Kent authorities would come on now, or be heard on the special clause submitted by them, asking that so much of the Kent Company's district as was outside the County of London should not be included in the Trust.

Mr. FITZGERALD said, when the case came forward, his first submission to the Committee would be that, having regard to the recommendations of the Royal Commission, and also the frame of the Bill, his learned friend's contention to take that large area out of the Trust was inconsistent with principle. Therefore, the matter properly arose on the constitution of the Board; but he did not think it mattered at what stage the special clause asked for was considered.

Mr. WEDDERBURN said he was content if it were understood that he might raise his whole point upon the clause submitted to the Local Government Board.

The CHAIRMAN: I have no doubt whatever that that is the best way. If we find a consequential amendment is necessary to clause 8, we will leave that open.

Mr. FITZGERALD then stated the case for the promoters on clauses 7 and 8, the intention and effect of which, he said, was to enable those boroughs and urban districts which were already supplying themselves—by their own water-works, or by arrangements of their own—to be the sole water authority within their district, so far as the Water Board was concerned. There were six such districts—viz., Richmond, Croydon, Cheshunt, Enfield, Tottenham, and Ware. The clauses had been inserted in the interests of these local authorities, in the belief that they would be acceptable to them. They appeared to be accepted by Richmond, which had not petitioned against the Bill; and Croydon was in substantial agreement, though desiring certain alterations. As to Cheshunt, Enfield, Tottenham, and Ware, who petitioned, if they did not desire to avail themselves of the clauses, the alternative was to strike them out; and the result would be to maintain the *status quo*.

Mr. *C. Perrin* was then called in support of the clauses, and he stated the facts with regard to the water supply of the six places named. In answer to Mr. RICKARDS, he said that Enfield, Cheshunt, Tottenham, and Ware supplied water either wholly to their districts or to parts of them, under the powers conferred upon them by the Public Health Acts. Enfield, in addition, had obtained a Provisional Order authorizing them to acquire land compulsorily. In all these four places the local authorities had supplies of their own, and were in fact supplying. The object of the clauses was to enable them to continue the supply to their own district; and, where the present Companies were supplying, to give them a right to demand from the Water Board a supply in bulk to supplement their own sources—in fact, to make them entirely independent of the Board.

Mr. *John Lithiby* was recalled; and in reply to Lord ROBERT CECIL, he gave details of the proposed modifications suggested by Hertfordshire with regard to Cheshunt and Ware. He said that Hertfordshire was not dissatisfied with the proposals, and the matters between them could be adjusted.

In cross-examination by Mr. BALFOUR BROWNE, on behalf of the Barnet District Gas and Water Company, witness said that a part of Enfield was supplied by the Urban District Council, another part by the New River Company, and another part by the Barnet Company. The whole of the district was within the limits of the New River Company; and if the clause were passed as proposed, the district would be handed over to the Enfield Urban District Council. He was aware that the Barnet Company supplied their part under an Act of Parliament, and that, presumably, under section 52 of the Public Health Act, the Enfield Urban District Council had no right to supply that portion. It was not the intention of the promoters to put into the hands of the Council anything which would enable them to exercise a power they did not now possess; and they would be prepared to exclude the district from the operation of the clause.

Mr. BALFOUR BROWNE asked whether, with regard to the rating question, if Enfield did purchase the New River portion of the works in the district, they would have to levy a rate to pay for them.

Witness said if it were a small amount, it would be paid for out of current rates, and if large, they would borrow money. Anyway, it would come out of the rates.

Mr. BALFOUR BROWNE: Would it be at all fair to levy rates upon my Water Company to enable the Enfield District Council to purchase the works of the New River Company?

Witness: I see no reason why you should not pay rates for every purpose for which they are charged.

Mr. DICKENSON then addressed the Committee on behalf of Tottenham. He said they desired to be included in the Trust, and did not agree to the clause which excluded them; nor were they willing to be struck out of the Bill altogether.

Mr. FITZGERALD pointed out that no deficiency rate would be levied in Tottenham.

The CHAIRMAN said that disposed of the rating question to some extent. If it were not clear in the Bill, it would be made so when the clause came to be dealt with.

Mr. DICKENSON, continuing, said that the position was this: The Local Government Board had left it to the option of Tottenham whether they would be included in the Trust or not, but objected to pay for the existing works, which cost £120,000, of which £50,000 was still outstanding. Tottenham was quite prepared to have the terms of purchase of the works settled on a reasonable basis, and desired to be included in the Trust if this were agreed to.

Mr. *W. H. Prescott*, Engineer to the Tottenham Urban District Council, said that Tottenham had a population of 106,000, with a rateable value of £412,000. It was surrounded by populations of a similar character, which districts were to be included in the Water Board; and under the Bill, as originally drafted, it was to have a representative on the Board. Since the decision of the Committee the previous day, the position of affairs was changed, and the decision would have the result that both Tottenham and other districts in Middlesex would be represented by representatives of the Middlesex County Council. Tottenham was supplied by three authorities—the New River Company, supplying 34,000; the East London Company, 6000; and the District Council, 66,000. Each of these bodies was entitled to supply the whole of the parish. The arrangement between the Companies was an amicable one—there was no binding agreement. Witness then proceeded to explain their sources of supply. The Council's supply was obtained from wells in the chalk, and was sometimes deficient. There was a 6-inch main connected with the East London Company, which supplied the deficiency. The Company had works of their own in close proximity to Tottenham, and had reservoirs in Tottenham. The New River Company had a very large pumping-station in Tottenham, and higher up the valley were wells belonging to the Companies. These wells undoubtedly affected the Council's water supply. The Council would be glad to extend their area of supply, but had been unable to do so because they had not sufficient water. The competition of a water authority responsible for the whole of London would be still greater than that already existing. To take water in bulk from either of the Companies would double the water-rate; and the Council looked with considerable alarm upon the proposal to take water in bulk very largely from the Trust.

In cross-examination by Mr. FITZGERALD, witness said the Water Board would entirely surround Tottenham, and would have wells in close proximity. He admitted there was exactly the same possibility of further wells being sunk by the Companies as by the Boards.

Mr. BALFOUR BROWNE then addressed the Committee on behalf of the Barnet District Gas and Water Company, on the lines foreshadowed by his cross-examination of Mr. Lithiby. He concluded by asking that the Company might be exempted from rates in regard to the Enfield Council's supply if they took over the works of the New River Company.

Mr. FITZGERALD asked if a clause on the following basis would satisfy Barnet with regard to the district of supply: "That nothing in this Act shall be construed as conferring on the Enfield Urban District Council any power of supplying water within so much of the urban district as is comprised within the statutory limits of supply of the Barnet District Gas and Water Company." That was subject to what Enfield might have to say.

Mr. BALFOUR BROWNE said, in principle, that met the case perfectly fairly. He understood the Enfield people did not object.

Mr. LITTLER then addressed the Committee on behalf of the Urban

District Council of Enfield. Enfield had, he said, spent £86,000 for their present works, of which £43,000 was still owing. They desired to be included in the Trust, on payment by the Water Board of the amount outstanding for the works. At present, there were three sources of supply—the Council supplying 36,000; the New River Company, 2700; and the Barnet Company, 900. About 1900 of the population were still obtaining their supply in a very unsatisfactory way from private sources.

Mr. *T. W. Scott*, Clerk to the Urban District Council, in answer to Mr. HUTCHINSON, gave the facts with regard to Enfield, and generally corroborated Counsel's statements.

In cross-examination by Mr. FITZGERALD, witness said that the New River Company had been asked to supply on the same terms as those now proposed to the Water Board—viz., payment of the outstanding debt on the works—and had refused.

In re-examination, witness said the New River Company had been supplying in bulk for the last two years.

In answer to Lord LLANDAFF, Mr. HUTCHINSON said that the Companies were not bound to supply in bulk.

Mr. *Richard Collins*, Engineer to the Enfield Council, said they could supply about 650,000 gallons, which was 20 gallons per head of population. That included the water taken from the New River Company. The Council would be put to an expenditure in order to make good their water supply, which was being depleted; and in order that this might be avoided, he had advised his Council to ask the Committee to include them within the area of the Water Board.

Mr. FITZGERALD then dealt with the question of rating raised by Mr. Balfour Browne on behalf of the Barnet Gas and Water Company. He said the ordinary basis of rating was that the whole rate was spread over the district; and the question of whether one ratepayer got an advantage another did not was not gone into. Turning to Tottenham and Enfield, he said that they both desired to be included in the Trust on payment for their works; and the only difference was that Enfield wanted the amount of the outstanding debt specified—viz., £43,000. They both appeared to be somewhat beyond the scope of the Bill, which was to acquire the undertakings of the eight Metropolitan Water Companies; but the principal objection to including them was that they wished to place the new Water Board under the obligation to purchase works which might prove to be of very little value to it. He would leave the decision entirely to the Committee; but hoped that, if they acceded to the request, they would not fix the price of the Enfield works at £43,000, but leave both cases to arbitration.

In answer to the CHAIRMAN, Counsel said that Enfield was wholly within the limits of supply of the New River Company, which Company must, if called upon, give a supply on conditions. He believed that in the case of Tottenham, the East London Water Company would, in like manner, be compelled to supply if called upon.

The CHAIRMAN asked whether, if the Committee came to the conclusion that the Tottenham water-works were to be purchased, any other cases would be affected by the decision.

Mr. FITZGERALD said that Richmond at present was satisfied; but they might ask for a decision to the same effect. Limiting it to local authorities and not including Companies, Tottenham and Enfield were the only two cases.

The Committee-room was then cleared; and on the re-admission of the public,

The CHAIRMAN said: The Committee are unanimously of opinion that Tottenham and Enfield should be struck out of clauses 7 and 8, that they should remain within the limits of supply of the new Water Trust, and that the water undertakings should be acquired by the Water Trust at their true value, subject to arbitration. The Committee have discussed the rating question which remains over in the case of the Barnet Gas and Water Company; but they would prefer not to pronounce any decision upon it until they see the exact terms of the rating clause, upon which important questions are to be raised regarding the incidence of a possible deficiency.

The petition of the Railway Companies was next considered.

Mr. FREEMAN said he appeared on behalf of the Great Northern Company, upon which the case of the whole of the Railway Companies would be raised, to save the time of the Committee, The point was very simple. Under clause 11 of the Bill, there was no exemption of any kind proposed in respect to any Railway Company. Under the Public Health Act, Railway Companies everywhere, except in London, were rated in respect to water, so far as their lines were concerned, only at one-fourth. On their stations, they paid exactly the same as all other owners of property, because there the company got certain benefits for which they were prepared to pay. In respect to the running lines, they got no benefit. Therefore it was the invariable practice all over the country, where corporations had to deal with water and levy a rate in aid, that railway companies should be exempted, except to the extent of one-fourth which the Public Health Act provided. He submitted there was no possible reason why the Railway Companies in London should be put in a different position, now that the water was passing into the hands of an authority which could levy rates in aid to make up any deficiency, than they were in in the great municipalities of the country. He proposed to bring up a clause exactly similar to the one in the Public Health Act, the important part of which to the Railway Companies was: "The occupier of any land used as a railway constructed under the powers of any Act of Parliament for public conveyance, shall be assessed, in respect to any rates to be levied or made under or for the purposes of this Act, in the proportion of one-fourth part only of the net annual value thereof."

In answer to the CHAIRMAN, Counsel said at present the Railway Companies paid by meter. A great many of them did not take water from the Companies at all, but found their own supply.

Mr. HUTCHINSON, for the Lea Conservancy, raised the same point. He asked for a clause to be inserted as follows: "That the petitioners' undertaking and property shall be exempted from any rate which may be leviable under the Bill."

Mr. FITZGERALD said the exemption asked for had never been allowed in London, which was especially exempted from the provisions of the Public Health Act. If the Committee accepted the suggestion, they would be for the first time altering the rating law in London, and giving an exemption to the Railway Companies which they had never enjoyed. Two years ago, the London Government Act was passed; but the Companies were not exempted under that Act.

Mr. FREEMAN said that it was the Water Board which proposed to alter the general incidence of rating in the Metropolis, and not the Railway Companies. At present, they were not under any obligation to pay for water unless they took it.

Mr. FITZGERALD, in answer to Lord CREWE, said he did not know the original reason of exemption of London from the provision of the one-fourth proportion. He could only suggest that the original Act which established the Metropolitan Board gave it a rating power, that the rating power then was not subject to these exemptions, and that had continued ever since. When the Public Health Act, 1875, was passed, it did not deal with the Metropolis at all. There were a succession of Acts from 1856 or 1857 dealing with London; and no exemption to the Railway Companies had been given.

In reply to Lord LLANDAFF, Counsel said that the Water Board was likely to cause the equalization of water-rates, of which some of the domestic consumers would get the benefit; but the Railway Companies would get none. This applied equally to all manufacturers.

Mr. FITZGERALD, in answer to Sir W. HOULDSWORTH, said that if the Railway Companies were exempted, it would only apply to the water part of the district rate.

The Committee deliberated in private, after which,

The CHAIRMAN said: The Committee cannot accept the proposal put before them; but, having regard to the circumstances in which the clause is brought up, and the limited nature of the application which it would have, they are anxious that the decision they have given should not be hereafter regarded as a precedent, either for or against the principle of similar petitions. They think the area of the discussion is too limited to afford them a reasonable ground for expressing an opinion on so wide a question.

The Committee then adjourned till to-day.

Buenos Ayres (New) Gas Company, Limited.—According to the report for the past year which will be presented at the annual general meeting of this Company to-morrow, the profit amounts to £52,149, of which £42,869 remains to be dealt with. From this amount £12,500 has already been paid to the shareholders as an interim dividend, free of income-tax; and the Directors recommend a final dividend of 9s. per share (free of tax), making 7 per cent. for the year, and leaving £7869 to be carried forward. Out of the year's revenue, the sum of £15,553 was expended on the upkeep of the works, mains, &c. During the year there was a net gain of 1093 meters fixed.

Water Supply for Yealmpton.—On Saturday, the 19th ult., the new water supply which has just been provided for Yealmpton, was turned on for the first time by Mrs. Bastard, wife of Mr. W. E. P. Bastard, the Chairman of the Parish Council, who has been the prime mover in the matter. The land for the reservoir was granted by Mr. Baldwin J. P. Bastard, of Buckland Court, at a merely nominal sum; and the works, which were carried out by Mr. S. Kingcombe, under the supervision of Mr. F. C. Clark, Engineer of the Plympton Rural District Council, have cost about £2000. The reservoir holds between 80,000 and 90,000 gallons of water, which is stated to be of very fine quality. Mrs. Bastard was presented with a silver key, suitably engraved, for the performance of the opening ceremony, and as a memento of the occasion.

Rochdale Gas Profits.—The result of the year's working to March 31 has been reported to the Rochdale Gas Committee. There is a net profit on the twelve months' business of £11,885, against £12,062 last year—or a decrease of £177. As was the case a year ago, the Committee have decided not to carry any of the profit to the reserve fund, but to devote it all to the relief of the rates. Detailed figures show that the cost of carbonizing has been £45,993, or a decrease of £2903, due, no doubt, to the lower price of coal, though this has affected the works for only the latter part of the financial year. Tar distillation cost £486 less than in the previous year; but the decreased returns from the sales of the products far more than counterbalance this decrease—the amount received from tar residuals being £2048 less than in the previous twelve months. Rates and taxes have gone up by £453, and interest and sinking fund charges are £200 higher. The total expenditure has been £76,163, against £77,748, or a decrease of £1585. On the income side, gas sold has brought in £62,934, compared with £62,771, or an increase of £163 only. Sales of residuals realized £25,091, against £27,040. From sulphate sales £327 more was made; and the sum received for coke was £228 less.

Penzance Water Supply.—An inquiry was held at Penzance recently, by Mr. M. K. North, representing the Local Government Board, as to an application for power to borrow £6000 for works of water supply. The larger portion of the sum—£4000—was for the sinking of a well and erecting pumping machinery. As to this, the Town Clerk (Mr. T. H. Cornish) explained that in 1896 a well was sunk in close proximity to the reservoirs, which at a depth of 100 feet yielded 90,000 gallons per day. The supply being still insufficient, the Council last year sunk another well. By the middle of December, they had reached a depth of 99 feet, and had driven two trial adits, and they had a daily yield of 250,000 gallons. With such very satisfactory results, the Council thought they had solved the question of water supply, which had been a source of difficulty since 1886. The water would be raised by a three-throw pump, driven by a 30 break horse-power oil-engine. As to the balance of the money, £1000 was for a reservoir to supply the high-level districts, and £200 for piping part of the present supply of water from the Trengwainton Valley to the reservoirs, so as to avoid the risk of pollution by cattle. It was proposed to construct a service reservoir of steel and concrete at a greater altitude than the existing reservoirs. This would hold 130,000 gallons, and would be supplied from the Trengwainton Valley and the new well—the overflow passing into the present reservoirs. The Surveyor (Mr. F. Latham) produced the plans and gave evidence as to the cost. No opposition was offered to any part of the scheme, except that two members of the Council expressed doubt as to whether the engine recommended was the most satisfactory for the purpose.

LEGAL INTELLIGENCE.

LAMBETH COUNTY COURT—Tuesday, April 29.

(*Before His Honour Judge* EMDEN.)

South London Electric Supply Corporation v. Bell.

The hearing of this case, which was to recover £1 3s. 4d. for electric current supplied from August, 1901, to December last, and which had been adjourned from the 16th ult. (*ante* p. 1039), was resumed to-day.

Mr. HARGREAVES, who appeared for the Corporation, said the Court would remember that, though the amount sued for was small, the point at issue affected some hundreds of cases, besides involving the honour of officials. Briefly, Mr. Bell's defence was that the words "and this agreement shall be operative under any circumstances for a period of not less than three years" were printed on his agreement after it had been signed by him.

Mr. *Wayre*, printer, stated that he printed the agreement produced. There was an order given for 500 copies; but after 100 had been delivered, a message came by telephone that an important clause had been omitted. The words "and this agreement," &c., were then printed on the 400 undelivered copies.

Mr. HARGREAVES: Was the additional printing put on any agreements which had been signed?

Witness: Certainly not. The agreements we put the clause upon had never left our place.

Mr. *Clement*, the canvasser who took Mr. Bell's order, and who witnessed his signature, was called. He said he could not swear whether or not the clause in small print was there when Mr. Bell put his name to the document.

Mr. *Herbert H. Boyer*, Secretary of the plaintiff Corporation, corroborated Mr. Wayre's evidence. He said there was no truth in the suggestion that the agreement had been altered after it was signed. The charge which had been made was a most serious accusation against himself; and he most emphatically denied it.

Judge EMDEN said the case was peculiar in several respects. On the one hand, Mr. Bell's tenancy would be up before the expiration of the three years. On the other hand, the plaintiff Corporation put in the fittings free, and it would be only reasonable for them to bind the customer for a term. Mr. Bell had already sworn most positively that he read the agreement carefully before signing it.

Miss *Maud Bell*, defendant's daughter, stated that she witnessed her father's signature, and was absolutely certain the clause about the three years was not on it when he signed. She read the agreement carefully—every word of it.

Judge EMDEN; If I remember rightly, defendant said, on the last occasion, he discontinued the light because he found gas better?

Defendant: That is so. I could get more light from one incandescent burner than from the whole six of these—16-candle power they call them.

Judge EMDEN: That is the sole reason for your discontinuing the supply?

Defendant: Yes, I could not get any light.

Judge EMDEN remarked that electric light companies had a bad system with respect to agreements, inasmuch as they did not supply a counterpart or a copy to the customer. How, he asked, was a man to carry in his head all the clauses of a long agreement?

Mr. *Boyer*, recalled, said copies of agreements were supplied if they were asked for.

Judge EMDEN: Why should people have to ask for them? Is your practice the custom of electric light companies?

Witness: I believe it is.

Judge EMDEN: Well, it is not a right system of doing business; and the sooner it is altered the better. Clearly the customer is entitled to a counterpart or copy of his agreement.

After some further remarks,

Judge EMDEN said: I find in the agreement this: "My tenancy expires day of ." In the present case, it was September 29, 1900. In diamond type underneath there is the clause about the three years. The two are absolutely inconsistent. This is the point: Defendant could not bind himself for three years when his tenancy expired previously. What do you say to that, Mr. Hargreaves?

Mr. HARGREAVES: There is ambiguity there, it must be admitted.

Judge EMDEN: There is more than ambiguity. Have you anything to say on the point, Mr. Boyer?

Mr. *Boyer:* We hoped he would renew his tenancy.

Judge EMDEN: People do not hope when they sign contracts. This shows the lax way these electric supply corporations have of doing business. I am glad I have not to decide whether the three years' clause was or was not on the agreement when it was signed. I think it was there. But, unfortunately, it is in very much smaller type than the rest of the document, and is in a place where no one would expect to look for such a thing. This was not a proper way to insert such an important clause—the most important, if it were valid, in the whole agreement. But I hold that it is not valid, as a man cannot bind himself for a longer term than his tenancy. The case must therefore be dismissed, with costs.

Wednesday, April 30.

Kent Water-Works Company and their Liabilities.

This was a case in which Mrs. Emily Maud Bastard, of 52, Lugard Road, Peckham, sued the Kent Water-Works Company to recover damages, laid at £20, for personal injuries sustained through the alleged neglect of the Company.

Mr. J. DE MONTMORENCY appeared for the plaintiff; Mr. A. H. CHAYTOR represented the defendants.

The facts were not in dispute. In December last a box-guard protecting a stopcock in a service-pipe between the Company's main and the premises of a consumer in Kincaid Road had sunk 2 inches below the level of the public pavement. Mrs. Bastard, while walking on the evening of Jan. 1, put her foot into the hole and fell, hurting herself somewhat severely.

Mr. CHAYTOR said the Company were in a different position from other similar concerns. His case was that, under their Acts, the consumer or householder was responsible for any accident.

Judge EMDEN: It is rather a startling proposition you put forward.

Mr. CHAYTOR: Oh, no; it is well known in the district, and is acted upon. In the present case, the work of raising the box-guard was done by the householder after the accident.

Judge EMDEN: Yes; probably after you had sent him a threatening notice.

Mr. DE MONTMORENCY argued that the Company were clearly liable. He quoted, in support of his view, the case of *Chapman v. Fylde Water-Works Company*.

Mr. CHAYTOR said his clients were in an almost unique position under their Acts of Parliament. Other water companies were compelled to make connections with the mains; but in the case of the Kent Company the consumers were required to do the work.

Judge EMDEN: Who does the repairs?

Mr. CHAYTOR: I will show that the Company never touched the apparatus in this case. They took no part in the laying down, the repair, or the taking of it up. The practice is, if the owner of a house wants a connection, he goes to the Local Authority, which in this case is the Borough Council; and, on making a deposit, he is given a licence to open the road. If he does not leave the pavement in good order, the work is done by the Local Authority, and the cost deducted from the deposit. This is the general practice in the district. Householders and owners have always been held responsible for accidents.

Judge EMDEN: That may be, and the Act may not justify the action. If it does, it is time it was altered in the interests of the public. Do you say seriously that your Act gives the householder power to break up the roads and make repairs?

Mr. CHAYTOR: I do. The Company were incorporated in 1809. By our Act, we have finished our work when the mains are laid; everything else falls on the householder.

Judge EMDEN: What sections do you rely upon?

Mr. CHAYTOR: Sections 52, 53, and 66 of the 1809 Act.

His HONOUR, having read these sections, stated that certain words pointed to something of the kind which Counsel suggested, but the sections did not contain a specific statement in favour of his contention. The Company took up a certain position, and it was incumbent upon them to show specific words to justify their attitude.

Mr. CHAYTOR said clause 52 clearly laid it down that householders could open the ground for the purpose of putting in pipes.

Judge EMDEN: But it does not say they are the only persons who are to do the work. Show me the specific words for the claim the Company make.

Mr. CHAYTOR: I have no specific words.

Judge EMDEN: So that all these years the Company have been issuing notices which they had no right to issue.

Mr. CHAYTOR said his contention was that, though there might be no specific words, the whole tenour of the Acts justified the Company's attitude.

Judge EMDEN: You make no claim to the connection-pipes or apparatus?

Mr. CHAYTOR: The householders may dig up the service-pipes and take them away, or do what they like with them. I may point out that in our Act of 1864, which was an Act to sanction amalgamation with the North Kent Water-Works Company, clauses 44 to 47 inclusive of the Water-Works Clauses Act, 1847, were expressly excluded, as they contained provisions for the undertakers to lay the pipes from the mains. That is the position we have always maintained, and, rightly or wrongly, it has been acquiesced in by the public.

Judge EMDEN: The Act gives you specific power to break up and repair, but it does not give the householder power to do so.

Mr. CHAYTOR: Not in so many words; but I contend that the duty to repair confers the power to do everything necessary to repair.

After some further discussion,

Mr. *A. Dickson*, jun., the Secretary of the Company, was examined by Mr. CHAYTOR. He stated that it had been the practice for many years for the Company to supply builders and owners of houses with stopcocks and boxes from the Company's stores at cost price. The builder or owner placed them in position, and the Company, after approval, made the connection. They did not do any work beyond making the connection with the main. If anything went wrong with the stopcock, the owner got his plumber to set it right.

In cross-examination by Mr. DE MONTMORENCY, witness said the Company exercised general supervision over the work of making the connections. In one estate, at New Cross, the owner and not the Company supplied the box-guards.

Judge EMDEN asked who laid the pipe in the Fylde case.

Mr. CHAYTOR replied that the Water Company did, on the demand, and at the expense, of the householder.

Judge EMDEN, in giving judgment, said practically the only point he was called upon to decide was whether the Water Company or the householder was liable. Owing to the extraordinary state of the statutes, he was very far from being free from doubt; but, in his opinion, the various Acts of Parliament did not justify the position taken up by the Company. It seemed to him that the householder was not given the power to break up the roads to repair, but that the Company were. Under all the circumstances, he held that the Company were liable to carry out the repairs; and accordingly he entered judgment against them for £20—the amount of damage which had been assented to as reasonable, with costs.

Mr. CHAYTOR intimated that, as the case was of very great importance to the Company, it would be carried to a Superior Court.

His HONOUR said he was glad to hear it. As he had already stated, he was far from being free from doubt about his decision.

The Ludlow Town Council have engaged Mr. H. P. Maybury, Engineer and Surveyor to the Malvern Urban District Council, to prepare a scheme for the sewering and water supply of the area added to the extended borough.

WEST BROMWICH QUARTER SESSIONS.

Wednesday, April 30.

(*Before Mr.* R. C. E. PLUMPTRE, *Recorder, and a Jury.*)

Charge of Falsification and Theft.

To-day Joseph Turner, 22, a clerk, of Fisher Street, Great Bridge, was indicted on a charge of falsifying books and stealing £1 on the 10th of January, and £3 on the 16th of January,* belonging to the Birmingham Corporation, by whom he had been employed at their gas-works at Swan Village.

Mr. A. H. M'CARDIE and Mr. C. YOUNG conducted the case for the prosecution; Mr. C. F. VACHELL and Dr. HAZEL defended.

Mr. M'CARDIE opened the case at considerable length. He said the prisoner had been employed by the Corporation for six or seven years, and had hitherto borne a good character. The evidence would disclose a system of fraud of a most ingenious and intricate character. The allegation was that the accused inserted the figure "1" in the £ column of the wages-book at the gas-works, in front of odd shillings and pence, so that when the total was added up the amount was larger than it should be. He afterwards erased the figure, so that the workmen did not receive the pounds when they were paid. He then appropriated the additional money and reinserted the figures, so that when the books were audited they were found to be accurate. There was a thinning of the paper, indicating that someone, said to be the accused, had been at work.

Mr. *G. R. Macintosh*, Chief Clerk at the works, stated that prisoner had had free access to the books, and assisted in paying the men.

In cross-examination, witness admitted having himself made erasions in the wages-book, but had never reinserted figures.

Thursday, May 1.

On the resumption of the proceedings this morning,

Mr VACHELL continued his cross-examination of Mr. Macintosh; but this did not occupy more than half-an-hour.

It was then explained that one of the principal witnesses for the prosecution—a junior clerk at the gas-works—was unable to attend in consequence of illness, and his depositions were produced. Numerous other witnesses were called, and evidence was adduced to the effect that prisoner had been in the habit of visiting the offices at the gas-works on Sundays, when he had no business whatever to be there. The Superintendent of the works (Mr. Johnston) had been suspended.

Mr. VACHELL then questioned the prisoner, who gave an emphatic contradiction to the allegations made against him. He never, he said, interfered with the wages-book on Sundays. He also denied that certain entries in the books of account were in his handwriting.

This closed the evidence.

Mr. VACHELL submitted that there was no evidence pointing to the slightest suspicious act on the part of the prisoner. There were, he said, no facts in the case for the prosecution, but only theory and suspicion. No one had been called who saw the books in prisoner's possession during the dinner hour, when the prosecution alleged that the offences were committed.

Mr. M'CARDIE having spoken at length in support of the case for the Corporation,

The RECORDER briefly summed up.

At 5.10 the Jury retired to consider their verdict. They had been absent about two hours when the Recorder requested their reappearance in Court, and proffered to enlighten them on any point they desired. They again retired, but subsequently reappeared, and the foreman (Mr. Hawkins) announced that they disagreed. The Recorder then reminded them that if they had the slightest doubt they should give the prisoner the benefit. The Jury once again retired, and at 8.15 returned a verdict of "Not guilty."

Mr. YOUNG said there was another indictment against the accused; but he did not propose to offer any evidence upon it. Prisoner was then discharged.

The Dispute as to a Coal Contract.

It may be remembered that in the "JOURNAL" for March 4 (p. 570) we reported the proceedings in an action brought by Mr. W. Spooner, the Mayor of Chesterfield, trading as the New Riber Colliery Company, against the Eveson Coal Company, Limited, of Birmingham, to recover £892 10s. for breach of a coal contract. The case was tried at the Derbyshire Assizes, before Mr. Justice Bruce and a Special Jury. The contract, which was dated the 1st of July, 1900, was for twelve months, the quantity being 12,000 tons, and the price 11s. 6d. per ton screened and 10s. 6d. per ton unscreened. In pursuance of the agreement, the defendant gave orders to the plaintiff for 7300 tons, which were duly delivered. Subsequently, the defendants refused to receive the remaining 4700 tons of the total quantity contracted for. In consequence of this breach of contract, the plaintiff was obliged to sell what he could of the coal, but at reduced prices; and notwithstanding his having done so, he had left on his hands 2623 tons. When the contract was entered into, prices were high; but shortly afterwards the rate became lower. The defence was that the coal supplied by the plaintiff was not suitable for making gas, and not equal to the guarantee given and accepted under the contract. At the trial, the Jury returned a verdict for the plaintiff, and judgment was entered in his favour; the question of damages being left to be settled between the parties. The defendants appealed, on the ground that the verdict was against the weight of evidence, and that the learned Judge not only misdirected the Jury, but failed to direct them by not leaving to them certain questions. The appeal was heard last Friday by Lords Justices Vaughan-Williams, Romer, and Mathew. Mr. M'Cardie appeared for the appellants; Mr. Buszard, K.C., and Mr. Etherington Smith for the respondents. At the conclusion of Mr. M'Cardie's argument, Lord Justice Vaughan-Williams said the case was a hopeless one for the defendants from the very first. There was nothing for him to do but dismiss the appeal with costs. The other Lords Justices concurred.

* See *ante*, pp. 424, 490.

Claim for Compensation for Summary Dismissal.

At the Bow County Court, on Monday last week, before his Honour Judge French, K.C., the case of *Reiffe v. Gaslight and Coke Company* was heard. The plaintiff claimed £2 for a week's wages in lieu of notice; and Mr. W. M. Thompson appeared on his behalf. He had been employed by the Company as a scoop-driver since 1891, as a "seasonal" workman under an agreement terminating in the spring, which required that 28 days' notice should be given or received on either side. The wages were £2 a week for day shifts and £2 6s. 8d. a week for night shifts. The shifts were worked in two-week periods from 6 a.m. to 2 p.m., from 2 p.m. to 10 p.m., and from 10 p.m. till 6 a.m. On the 21st of March, plaintiff and hundreds of other workmen were dismissed at a moment's notice, but were subsequently employed by the Company to do similar work to that done by them while the agreement was in force. His Honour asked whether, as plaintiff was employed after the agreement had expired, the ordinary incidence of law did not apply, and make him a weekly servant. He thought it was desirable, in the interests of regularity of employment, that some rule should prevail. It must be a dangerous condition of things if all these men were able at once to leave work without giving notice, which would possibly make them liable to a prosecution for conspiracy. There was a horror of leaving things of this kind open; and, above all things, he considered that this branch of labour should be protected by regulations on one side and the other. In giving judgment, he said the Company were the best judges of what men were the most competent for their business. Of the three classes of workmen employed, the regular men differed in no respects from the others, except that they were under an agreement by which they were entitled to give or require four weeks' notice—a necessary provision, having regard to the nature of the Company's business. The second class of men were those from whom the Company did not require so long a notice, but whom they employed continuously and regularly, and, as in the case of the present plaintiff, for a period of nine months. It was the second class with whom he was dealing; and, there being nothing in the shape of a definite agreement that no notice should be required, he thought the ordinary incidence of law, as between employer and employed, prevailed. As he found, as a fact, that there had been continuous employment for several months, he held that the only legal inference to be drawn was that the employment was subject to the implied legal condition of one week's notice on one side or the other. The plaintiff was therefore entitled to recover; but as the case was one of great importance, he would certify for Counsel's fees. Mr. Vaughan Williams, who (instructed by Messrs. Bedford, Monier-Williams, and Robinson) appeared for the Company, applied for leave to take the case, which was a test one, to a Superior Court. His Honour, however, said that as the amount in dispute was only £2, he could not grant it.

Charles Bright's Lighting Companies.

At the Guildhall Police Court, last Friday, Mr. Alderman Smallman sat for the 22nd time to hear the charges against Charles Bright, the American electrical engineer and company promoter, of Buenos Ayres, and recently of 14, Copthall Avenue, Joaquin Fermin Moreno, of the American Legation, Buenos Ayres, and Robert George Fudge, Secretary, of having conspired together to defraud the creditors of Charles Bright and Co., and Bright's Light and Power Company by concealing some £100,000 of shares at the time of Bright's examination in bankruptcy. Bright was apprehended in the middle of January. It was stated that he had obtained certain electric lighting concessions from ex-President Kruger at Pretoria, and had come to this country to form companies in London and Birmingham for working them. The case for the prosecution closed about three or four weeks ago, and since then Bright has engaged the attention of the Court with his defence that the shares he was alleged to have concealed were not, in fact, his. Further witnesses having given evidence to this effect, the defence was closed; and the case was sent for trial at the next Old Bailey Sessions.

The Custody of Prepayment Meters.

At the Longton Borough Police Court last Wednesday, Robert Edmundson was summoned by the Longton Gas Committee for non-payment for gas consumed. The register of defendant's prepayment meter showed that 4800 cubic feet of gas had been consumed; but whereas there should have been 19s. in the box connected with it, the inspector found nothing at all. The meter was smashed, and apparently a robbery had taken place. The Town Clerk (who appeared in support of the summons) contended that defendant was responsible for the safekeeping of the meter, and quoted from the Act of Parliament to show that this was so. Whatever, he said, had happened on defendant's premises, had nothing to do with the Corporation. Until a short time ago, meter-rents were charged by the Corporation; and were these still in operation, he thought the case could not have been raised. The meters were put in for the convenience of the consumer; and if a consumer pleased, he could have his own gas-meter. Mr. Graham, for the defendant, laid stress upon the fact that the meter in question was a peculiar kind of meter, and one which had been brought into vogue within recent years. The Act of Parliament of the Corporation was necessarily silent upon this sort of meter. A few years ago, the Corporation tried to throw the responsibility for the safekeeping of these slot meters on the public, by providing a special form of agreement. Clause 1 of this agreement said: "The payment shall be made by placing pennies in the prepayment box, attached to the meter for that purpose; and for the safe custody thereof the consumer shall be accountable to the Corporation until the money shall have been collected by the Corporation officers." He contended that the very fact of the Corporation having drawn up this special agreement went to prove the Corporation's liability. His client, however, had not

signed the agreement, and could only be affected by the common law. The Council, said Mr. Graham, had chosen their own agency, had perfect control over the box, and might have sent for the money any day. It was, furthermore, a cash, and not a credit sale. Therefore he held that the Corporation were the responsible parties. Even supposing the money was a bailment, his client could not be held responsible without negligence on his part could be proved. The Town Clerk stated that the agreement mentioned was not in operation when defendant took the meter. He did not contest the statement that a robbery had taken place. It was, he said, purely a point of law as to who was responsible in the case of money which had been taken from the box of a prepayment meter. The sections of the Act, he submitted, went to show that, until the money was actually in the hands of the Corporation, the consumer was responsible. The Bench made an order for payment of the arrears. Mr. Graham asked leave to appeal; and this was granted.

Deficient Illuminating Power of Gas in North London.

At the North London Police Court last Friday, before Mr. Fordham, the Gaslight and Coke Company were summoned, at the instance of the London County Council, for supplying at the testing-place at Hornsey-Road, Holloway, on the 15th of February last, gas of less illuminating power than is required by the Company's Act of 1876. Mr. W. E. Helman-Pidsley prosecuted; and the Company were represented by a clerk from the Secretary's office. Mr. Helman-Pidsley said the Company were bound to supply gas of an illuminating power of 16 candles, and they were liable to the forfeiture of 40s. for the first half candle below that standard and £25 for every subsequent one. On the date named, the District Examiner made four tests at Hornsey Road, with the following results in candle power: (1) 15·45, (2) 15·26, (3) 15·42, and (4) 15·18—the average being 15·32 instead of 16. The results were communicated to the Company, and notice of appeal was given; but on Feb. 25 their officials wrote to the Chief Gas Examiner withdrawing the appeal. This action stopped evidence from being tendered now as to the illuminating power of the gas. The Company admitted the deficiency, and did not wish to contest the case. The clerk who appeared confirmed this. The Company admitted their liability; and his Worship ordered them to pay 40s., with 2s. costs. The clerk in attendance paid the money.

Responsibilities of Prepayment Meter Consumers.

At the Chester City Police Court last Thursday, John Moore, a tailor, of Fosbrook Street, was summoned by the Chester United Gas Company for 10s. 6d.—viz., 7s. for gas consumed, and 3s. 6d. damage to the lock of a penny-in-the-slot gas-meter at 23, Dee Lane, Chester, where he had resided. Mr. F. B. Mason appeared on behalf of the Company, and it was stated that defendant signed the customary undertaking, making himself responsible for any damage done to the meter or fittings, and also for the quantity of gas consumed as registered by the index. On April 25, a collector visited the house, and found a tenant named Mrs. Tatler there—Moore having left some time before. The lock of the meter was discovered to have been damaged; and instead of 9s. 4d. being in it, there was only 2s. 4d.—the rest having been abstracted. Defendant should have given the required notice to the Company when leaving the house. In reply to the Bench, defendant denied having signed the undertaking, and said the signature was a fraud; in fact, he had never seen the document. At the request of the Bench, he signed his name; whereupon the Clerk said the Magistrates would not believe that the signature on the document was not defendant's. Evidence was called in support of the case, after which defendant's wife said she remembered the document being left at the house. The Bench thereupon obtained her signature, and expressed the opinion that she had signed instead of her husband. Defendant said he left the meter in good order when he removed, and there had been two tenants in the house since he left, one of whom admitted having used gas. In that Court he had heard for the first time that the document had been left at his house. The Magistrates made an order for the payment of the amount claimed.

Disputed Prepayment Meter Consumption.

At the Smethwick Police Court last Thursday, H. F. Worrall and R. Slater were summoned, at the instance of the Gas Department, for the non-payment of amounts alleged to be due for gas supplied. Mr. Botteley, who appeared to prosecute, explained that on the premises occupied by the defendants there had been placed prepayment meters. The point in dispute was as to the amount of gas consumed. The meters were fitted up with registers; and they were certified by Government inspectors as being correct. Sometimes, however, the automatic machinery which shut off the valves failed to act; and the result was that the consumers obtained more gas than they were entitled to. If the money taken out of the meter was not equal to the amount of gas consumed, an account was sent in to the consumers, who usually paid. The parties who were supplied with prepayment meters signed an agreement to pay for gas consumed, and to abide by the index. H. E. Jarvis (an inspector) deposed to visiting the house occupied by Worrall on Sept. 25 last, and finding that the meter indicated that 2375 cubic feet of gas had been consumed. As the rate charged was 3s. 4d. per 1000 cubic feet, there should have been 7s. 11d. in the meter; but he only found 5s. 5d. in the box. On the application of defendant's wife, who wished to have further advice, Worrall's case was adjourned for a week. In the case of Slater, evidence was given that the meter registered a consumption of 3800 cubic feet of gas; but only 7s. was found in the box—there being a deficiency of 5s. 8d. The Bench made an order for payment, or in default a distress warrant to issue.

It will be seen by an announcement which appears in our advertisement columns to-day, that the East London Water-Works Company are offering for public tender £250,000 of 3 per cent. debenture stock, under their Act of 1900.

MISCELLANEOUS NEWS.

THE EXAMINATIONS IN GAS MANUFACTURE.

The Polytechnic Question Papers.

In the "JOURNAL" last week, we gave the questions set at the recent examinations in "Gas Manufacture" held by the City and Guilds of London Institute. Below are those with which Mr. Walter Grafton, F.C.S., the conductor of the classes for this subject at the Polytechnic, Regent Street, tested the extent of his pupils' knowledge thereof:—

HONOURS GRADE.

1. State in general terms the effect of varying the temperature of retorts on the production of gas, and the quality of the same; and is the tar influenced in any way? 2. Give a sketch of a setting of inclined retorts, particularly to show the method of heating the upper and lower ends equally. 3. What is the benefit claimed for condensing gas under pressure? Briefly describe the method. 4. How would you determine the composition of producer and waste gases, and what amount of carbonic oxide would you expect to find in the producer gas from a well-regulated generator setting? 5. Describe the use of the calorimeter. What effect should you expect to find by using 14 and 16 candle gas respectively made from Newcastle coal? 6. Give a sketch of an arrangement of purifiers and valves for the complete purification of coal gas, and state what materials you would employ in the purifiers. 7. Give the chemical composition of coal gas and the effect of each component upon the illuminating and calorific power of the gas. 8. Draw and describe one form or method of guiding gas-holders. 9. How would you determine the quantity of naphthalene in coal gas? Give the approximate quantity found in the summer and winter time, and state what these results teach us. 10. State fully the advantages of stoking machinery over any other method of charging and drawing retorts.

ORDINARY GRADE.

1. Describe the carbonization of coal for gas production, and state what you understand by "high" heats as applied to this process. 2. What are the approximate gaseous products that pass into the foul main, and what is the effect of condensation upon them? 3. Draw and describe the horizontal condenser. 4. Clearly describe the functions of the tar-extractor and washer-scrubber, and show the relative effect of each apparatus on the gas. 5. State how you would purify washed gas from sulphuretted hydrogen; naming the materials you would use. 6. Describe a station gas-meter, and how its accuracy is maintained. Give sketches. 7. What are the advantages of incandescent gas lighting over the older systems? 8. How would you test gas for its illuminating power by the table photometer? Give the method of finding result. 9. A sample of spent oxide is given you, how would you determine the amount of sulphur in it? 10. What are the products resulting from the combustion of London gas? Classify the following gases as diluents and illuminants: Hydrogen, carbonic oxide, marsh gas, acetylene, nitrogen, and carbonic acid.

Four hours were allowed for each paper. The Examiner specified that in the ordinary grade Nos. 2 and 3, and in the honours grade Nos. 2 and 7, were to be attempted, and not more than eight questions answered in either grade.

WINDING UP OF THE MORECAMBE GAS COMPANY.

The Final Meeting of the above-named Company was held on the 24th ult.—Mr. W. G. WELCH in the chair.

The Directors, in their report, stated that the outstanding accounts had been settled, and that the winding up of the Company could now be completed. Under the scheme of distribution approved by the proprietors on March 22, 1901, the mortgage bonds received from the Morecambe Urban District Council for the amount of the purchase-money of the Company's undertaking (£141,000) had been distributed among the holders of the stocks of the Company, as follows:—

£10,406 of 6 per cent. preference stock, at 220 per cent..	£22,893	4	0
£20,000 of ordinary stock, at 515 per cent.	103,000	0	0
£3600 of new ordinary stock, at £413 13s. 9d. per cent.	14,892	15	0
Small balance sold	214	1	0
	£141,000	0	0

Under the scheme, a sum of £240 was distributed among the officials and servants of the Company, £2000 was paid to the Secretary and Manager (Mr. Duff), £2000 to the Directors, and £50 to the Auditor. By the wish of the shareholders, expressed at the meeting, the Directors had presented to Mrs. Duff, the wife of the Manager, a silver tea service; and they would hand a donation of £105 to the Morecambe Queen Victoria Jubilee Cottage Hospital. In the settlement with the District Council, the Directors retained the amount of the reserve fund, £2153 18s. 6d., and the balance of the profit and loss account, £2925 0s. 9d. The stock in hand on June 30, 1900, was estimated at £1104 15s. 6d.; but as the undertaking was sold as a going concern, the Directors did not consider they would be justified in asking the purchasers to pay for the stock in addition to the amount of the purchase-money. The Council had repaid to the Company the amount of the parliamentary and legal expenses (£1105 8s. 7d.) in connection with the agreement and the Council's Gas Bill, and also the expenses of the winding up of the Company (£115 10s.). The balance-sheet, which accompanied the report, showed a balance in hand of £1951 9s., which, according to the scheme, was to be distributed among the proprietors of the consolidated and new ordinary stocks. It allowed of the payment of £8 10s. 6d. on each £100 of the former, and of £6 16s. 11d. on each £100 of the latter.

The CHAIRMAN, in moving the adoption of the report, congratulated the shareholders on the successful completion of the winding up. He was glad to say the Directors had been able to settle all questions with the District Council in a friendly spirit; for on both sides he believed there had been the desire to carry out the conditions of the agreement in a fair and reasonable manner. Of course, the purchase of the gas undertaking had not been so immediately profitable to the Council as they and the Directors anticipated. The causes of this were not, and could not have been, foreseen. First was the great rise in the price of coal; secondly, the advance in the value of money owing to the war. The Council had calculated on being able to borrow at 3 per cent. or under the money needed for the purchase; but when the time for payment came, they found they could not borrow at less than 4 per cent. At the time the bargain was made, the terms were considered reasonable. The purchase price was not fixed by the Directors. The arrangement was for the price to be settled by arbitration; but, at the request of the Council, the Directors agreed to leave the fixing of the price to three eminent Gas Engineers—two representing the Council and the other the Company. The price they agreed upon, it would be remembered, was called in question by the Heysham District Council; and, first before a Committee of the House of Commons, and then before one of the House of Lords, the terms of purchase were very fully considered, and in each case the Committee were satisfied. With regard to the ultimate result of the purchase, he felt no doubt whatever. The Council had acquired works in splendid condition; and when the war was over and prosperity returned, they would earn for the ratepayers of Morecambe very handsome profits. In Mr. James Duff, the Council had a Manager who had received an excellent training, and who had shown marked ability in all departments of his work. In addressing the shareholders for the last time, he thanked them for the kindness they had always shown to the Directors. The relations between them had been most amicable. The Board had endeavoured to work for the best interests of the shareholders, and the shareholders had always been ready to support them.

Captain BRIGGS briefly seconded the motion, which was carried unanimously.

Mr. ROPER, in proposing a vote of thanks to the Chairman, said he took this opportunity of testifying to the great attention the Chairman had always paid to the business of the Company, and more especially in connection with its winding up, which had been a most pleasant business. The Directors had been met in every way in the most considerate manner, and they had derived very great assistance from the way in which the Liquidator (Mr. W. Duff) had done his work.

Mr. DUFF, who seconded the vote of thanks, said his duties had also been pleasant, thanks largely to the great assistance he had had from Mr. Welch. He would like to take this opportunity of expressing his thanks to the Chairman and the other Directors for past kindnesses to him when the undertaking was being carried on. He was quite sure the Council had purchased good works, and in a very short time they would be a great benefit to the town.

The vote was carried with acclamation, and the proceedings closed.

THE LIGHTING QUESTION AT DOWNHAM MARKET.

It may be remembered that at the last monthly meeting of the Downham Market District Council, it was decided, after a very warm discussion, to revert to gas, instead of continuing the use of oil, for street lighting purposes; and the terms submitted by the Gas Company were accepted. It was thought that this decision would settle a matter which has been the means of creating an animated controversy in the town. But those members of the Council who thought that better terms should be obtained from the Company before another contract was entered upon were not prepared to abide by the decision without making another endeavour to carry the point which, in face of considerable opposition, they had so consistently urged. A special meeting of the Council was therefore demanded, upon the requisition of Mr. T. H. Wenn and others, with the object of rescinding the resolution come to by the Council to pay the Company 43s. 6d. per lamp per annum for lighting the town for five years; and it was held a few days ago. Mr. Wenn, in moving a formal resolution of rescission, said he was in favour of lighting the town by gas; but he was decidedly averse to paying 27s. 6d. for what they should get for 20s., and he could not imagine that the members of the Council would consent to fritter away the money of the ratepayers. At the last meeting, the Lighting Committee admitted that they had not made calculations, and had not estimated the cost to see if the offer made by the Company was a reasonable one. They made the recommendation simply because the Company had come down from 52s. 6d. to 43s. 6d.; and because of this reduction they thought it must be cheap. But he had taken the trouble to go into the matter, and had estimated the cost, and his figures had not been disputed. He found that if the lamps were lighted in accordance with their requirements, each lamp would burn 1360 hours per annum. With 3-feet burners the consumption of gas would be 5080 cubic feet; but as by the use of incandescent mantles there would be a 25 per cent. saving of the gas consumed, the total amount of gas used would be reduced to 3810 cubic feet. This quantity, at 5s. 6d. per 1000 feet—the same rate as that charged to private consumers—would be £1 1s., which, with the cost of lighting at 6s. 9d. and an allowance of 1s. 8d. for incandescent mantles per lamp, would bring the total cost up to 29s. 5d. per lamp. Surely, as the largest consumers, they should be charged at a lower rate than private consumers. But he was content to estimate at the same price as that paid by the general public. In the face of the figures he had given, he could not understand how any Committee could recommend that the Council should pay 43s. 6d. per lamp. He did not wish to rescind the decision to have gas again, but 43s. 6d. was too much to pay for what they ought to get for less than 30s. He was also against making a contract for five years. If the price of coal fell, the town ought to have the benefit of the fall; while if the cost increased, let them pay for it. Mr. Beart seconded the motion. Mr. J. R. Bennett challenged the accuracy of Mr. Wenn's calculations. He said he also had gone into figures, and he found that the gas would be burned for 1366, and not 1360 hours.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 1197.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p.c.	18—19	..	5 10 6
100,000	10	,,	7½	Do. 7 p.c.	13—14	..	5 7 2
300,000	100	Jan. 2	5	Australian 5 p.c. Deb. .	100—102	..	4 18 0
200,000	5	Nov. 13	6½	Bombay, Ltd. . . .	6⅞—6⅞	..	4 16 4
40,000	5	,,	6½	Do. New, £4 paid	4¾—4¾	..	5 9 5
380,000	Stk.	Feb. 13	12	Brentford Consolidated	257—262	..	4 11 7
270,000	,,	,,	9	Do. New . . .	188—193	..	4 13 3
50,000	,,	,,	5	Do. 5 p.c. Pref. .	128—133	..	3 15 2
206,250	,,	Dec. 13	4	Do. 4 p.c. Deb. .	112—115	..	3 9 7
220,000	Stk.	Mar. 13	10	Brighton & Hove Orig.	203—208	..	4 16 2
246,320	,,	,,	7	Do. A. Ord. Stk. .	147—152	..	4 12 1
420,000	20	Apl. 11	10	British.	40—41	..	4 17 7
50,000	10	Feb. 13	12	Bromley, Ord. 10 p.c. .	23—25	..	4 16 0
82,850	10	,,	9	Do. 7 p.c. . . .	18—20	..	4 10 0
500,000	10	Oct. 11	6	Buenos Ayres (New) Ltd.	10—11	..	5 9 1
220,000	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	94—97	..	4 2 6
150,000	20	Mar. 13	8½	Cagliari, Ltd. . . .	21—23	..	7 3 6
100,000	10	Sept. 27	10	Cape Town & Dis., Ltd.	15—16	..	6 5 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	53—55*	..	5 9 1
550,000	Stk.	Apl. 11	12	Commercial Old Stock	267—272	..	4 8 3
236,425	,,	,,	9	Do. New do. .	205—210	..	4 5 9
238,237	,,	Dec. 13	4½	Do. 4½ p.c. Deb.	130—135	..	3 6 8
800,000	Stk.	,,	9	Continental Union, Ltd.	148—153	−2	5 17 8
200,000	,,	,,	7	Do. 7 p.c. Pref.	157—162	..	4 6 5
575,000	Stk.	Feb. 27	5	Crystal Palace Ord. 5 p.c.	120—125	..	4 0 0
60,000	,,	,,	5	Do. 5 p.c. Pref.	122—127	..	3 18 9
486,090	10	Jan. 30	10½	European, Ltd. . . .	18¾—19¾	..	5 7 8
354,060	10	,,	10½	Do. £7 10s. paid	13¾—14¾	..	5 8 8
15,243,200	Stk.	Feb. 13	4 5/16	Gas-light and Coke	4 p.c. Ord. . .	92—94	−2	4 13 7
2,600,000	,,	,,	3⅜		3⅜ p.c. max. .	89—91	..	3 16 11
3,799,735	,,	,,	4		4 p.c. Con. Pref.	108—111	..	3 12 1
4,193,975	,,	Dec. 13	3		3 p.c. Con. Deb.	50—52	..	3 5 3
70,000	10	Nov. 13	8	Hongkong & China, Ltd.	13—14	..	5 14 4
3,800,000	Stk.	Nov. 13	10	Imperial Continental .	211—214	..	4 13 6
473,600	Stk.	Feb. 13	3½	Do. 3½ p.c. Deb. Red.	100—102	..	3 8 8
561,000	Stk.	Feb. 27	10	Liverpool United A	213—222	..	4 10 1
718,100	,,	,,	7	Do. do. B .	168—170	..	4 2 4
306,083	,,	Dec. 30	4	Do. do. Deb. Stk.	118—120	..	3 6 8
75,000	5	Dec. 13	4	Malta & Medn., Ltd. .	4¼—5	..	4 0 0
560,000	100	Apl. 1	5	Met. of 5 p.c. Deb.	105—109	..	4 11 9
250,000	100	,,	4½	Melbourne 4½ p.c. Deb.	101—103	..	4 7 5
541,920	20	Nov. 13	3½	Monte Video, Ltd. . .	9½—10⅜	..	6 13 4
1,595,892	Stk.	Feb. 21	4⅜	Newc'tle & G'tesh'd Con.	107—108	..	4 1 0
346,855	Stk.	Dec. 27	3½	Do. 3½ p.c. Deb.	98—100	..	3 10 0
150,000	5	Nov. 28	8	Oriental, Ltd. . . .	7¼—7¾	..	5 3 3
135,000	4½	,,	8	Do.	6½—7	..	5 2 11
15,000	1	,,	8	Do.	11—12	..	4 11 5
60,000	5	Mar. 13	7	Ottoman, Ltd. . . .	6—6⅜	..	5 7 8
					* Ex. div.		

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
851,070	10	Apl. 25	7	River Plate Ord. . .	10—10⅜*	..	6 13 4
250,000	Stk.	Dec 30	4	Do. 4 p.c. Deb..	95—98	..	4 1 8
250,000	10	Mar. 26	8	San Paulo, Ltd.. . .	11½—12½	..	6 8 0
135,000	Stk.	Mar. 13	10	Sheffield A	239—241	..	4 3 0
209,984	,,	,,	10	Do. B	238—240	..	4 3 4
523,498	,,	,,	10	Do. C	237—239	..	4 3 8
5,850,000	Stk.	Feb. 13	5	South Met., 4 p.c. Ord.	121—123	−1	4 1 4
1,627,965	,,	Jan. 16	3	Do. 3 p.c. Deb. . .	92—94	..	3 3 10
380,940	Stk.	Nov. 13	5	Southampton Ord. . .	104—108	..	4 12 7
70,825	,,	Jan. 16	4	Do. 4 p.c. Deb.	100—102	..	3 17 8
120,000	Stk.	Feb. 27	5½	Tottenham and Edmonton A. 5 p.c.	120—125	..	4 8 0
260,520	,,	,,	4	Tottenham and Edmonton B. 3½ p.c.	93—98	..	4 1 8
182,380	10	Jan. 16	5	Tuscan, Ltd.. . . .	7—8	..	6 5 0
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.	97—100	..	5 0 0
230,000	5	Mar. 13	9	West Ham, 10 p.c. . .	9—10	..	4 10 0
172,000	10	,,	6	Do. 7 p.c. . .	12½—13½	..	4 8 11
140,900	Stk.	Dec. 30	4	Do. 4 p.c. Deb.	105—110	..	3 12 9
				WATER COMPANIES.			
780,599	Stk.	Dec. 30	11⅓	Chelsea, Ord. . .	310—320	..	3 11 11
150,000	,,	,,	5	Do. 5 p.c. Pref. .	155—160	..	3 2 6
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75	140—145	..	3 2 1
175,785	,,	Mar. 26	4½	Do. 4½ p.c. Deb. .	140—145	..	3 2 1
1,720,560	Stk.	Mar. 26	8	East London, Ord.. .	205—210	+1	3 16 2
654,740	,,	Dec. 13	4½	Do. 4½ p.c. Deb. .	143—148	..	3 0 10
1,018,046	,,	,,	3	Do. 3 p.c. Deb. .	96—98	..	3 1 3
700,000	50	Dec. 13	8	Grand Junction 10 p.c. max..	115—120	..	3 6 8
310,000	Stk.	Mar. 26	4	Grand Junction 4 p.c. Deb..	127—130	..	3 1 7
708,000	Stk.	Feb. 13	16	Kent	300—310	..	5 3 3
160,000	,,	,,	7	Do. New, 7 p.c. max..	200—210	..	3 6 8
1,043,800	100	Dec. 30	10½	Lambeth, 10 p.c. max..	295—300	..	3 10 0
406,200	100	,,	8	Do. 7½ p.c. max..	210—220	..	3 12 9
350,000	Stk.	Mar. 26	4	Do. 4 p.c. Deb..	125—130	..	3 1 7
500,000	100	Feb. 13	12 8/10	New River, New Shares	405—415	..	3 1 8
1,000,000	Stk.	Jan. 30	4	Do. 4 p.c. Deb..	127—130	..	3 1 7
902,300	Stk.	Dec. 13	7	South-wark and Vaux-hall Ord. . . .	193—198	..	3 10 8
126,500	100	,,	7	South-wark and Vaux-hall 7½ p.c. max.	185—190	..	3 13 8
489,200	Stk.	,,	5	South-wark and Vaux-hall 5 p.c. Pref..	153—158	..	3 3 3
1,019,585	,,	Apl. 11	4	Vauxhall 4 p.c. A Deb.	125—130	..	3 1 7
1,155,066	Stk.	Dec. 13	10	West Middlesex. . .	290—300	..	3 6 8
200,000	,,	,,	4½	Do. 4½ p.c. Deb. .	140—145	..	3 2 1
200,000	,,	Mar. 13	3	Do. 3 p.c. Deb. .	95—97	..	3 1 10
					* Ex. div.		

Then they would have lamps not of 50 or 60, but of 75-candle power. For the gas the lamps would consume, and for the gas only, the cost worked out at £1 10s. 3d. per lamp. Half-a-crown would be a reasonable figure to allow for incandescent mantles; while for labour in lighting the lamps 10s. was a fair amount. This made £2 2s. 9d., and they had agreed to pay the Company 9d. more—a very small margin to allow for plant. He appealed to the members to vote as the town desired them to do. On a vote being taken, the motion was lost by 20 to 9—some councillors remaining neutral. The result was well received.

OSSETT CORPORATION GAS SUPPLY.

Improvements at the Gas-Works—Extension of the Supply.

Our readers may remember that about nine months ago the Corporation of Ossett acquired the undertaking of the Ossett Gas Company at a cost of £116,000, and appointed Mr. Arnold E. Mottram, of Hyde, as their Manager. Under his supervision, the Gas Department has been placed on a thoroughly businesslike footing. Efforts are being made to popularize the use of gas for cooking purposes and for motive power; and a shop has been opened in the Market Place, and another at Horbury, where stoves and other appliances are on view. At present, no reduction is made in the charge for gas used for the above-named purposes; but the Gas Committee are hoping to be able to do this by effecting economy in the cost of production. With this object in view, they have lately approved of a scheme prepared by Mr. Mottram for modernizing the works at a cost of about £6000, and have taken the first step towards carrying it out by accepting a tender submitted by Drakes Limited, of Halifax, for an installation of horizontal retorts with generator furnaces. The work is to be carried out in two sections for convenience; and the first will be completed by next winter, and the second by the summer of 1903. The new plant will allow of an increased output of gas, which will certainly be required in the near future. In fact, the Corporation have already made arrangements for supplying the Local Authorities of the outlying districts of Crigglestone and Shitlington with gas—a luxury in the matter of lighting which, notwithstanding their proximity to towns which for half-a-century have been provided with this illuminant, they have never enjoyed. Under the agreement that has been entered into, the Ossett Corporation will lay about two miles of pipes in Crigglestone, and a similar length in Shitlington, the Urban District Councils will pay for the street-lamps, and the villagers will have gas supplied to their homes and places of business at 3s. 3d. per 1000 cubic feet—only 3d. more than is being charged in Ossett. It is estimated that for a start there will be a demand for something like 3 million cubic feet of gas per annum; and it is thought that the improved lighting will in due course lead to the expansion of these long-neglected districts. Middlestown, Netherton, and the surrounding villages, are still using oil-lamps and candles. After dark they must present a striking contrast to Ossett, where the streets are illuminated by incandescent lights.

MESSRS. R. & J. DEMPSTER'S NEW OFFICES.

In order to meet the increasing demands upon the staff of the above-named firm, it was necessary some time ago to provide additional office accommodation, which has lately been completed. The new offices are, correctly speaking, an extension of the original block, and are built to correspond with it. The interior of the old building has been re-arranged, and ample room secured for the various departments. A new and well-lighted drawing office, fitted with patent adjustable boards and the customary accessories, is on the first floor; while the chief draughtsman, estimater, and typist have separate rooms opening from it, and dining-rooms for the Directors and staff have been provided. The offices of the Directors, Manager, correspondent, and private clerk, with the waiting-room, complete the arrangements on the first floor. Beneath are the general offices, and those of the Secretary, Works Manager, cashier and clerk, the pay and weigh offices, and the lavatory accommodation. Telephones are connected to the Manchester Exchange, the Telegraph Office, and the trunk system; while each room has intercommunication, by means of telephone, to the other rooms and to the heads of each department in the works. Manchester has an unenviable reputation for fog and dull weather; but to meet this, apparatus has been erected to copy tracings and plans independently of atmospheric conditions. Incandescent gas-burners of the latest type are fitted throughout. Each room is well ventilated, and provision has been made to prevent as far as possible the noise inseparable from constructional work. The offices are heated by means of radiators connected with one underground boiler, with governors in each room to secure perfect control. The kitchen has been remodelled, and, in addition to providing for the staff, any of the workmen may, at the lowest possible cost, obtain meals or refreshments. The completion of the new premises was celebrated by a banquet at the Mosley Hotel, Manchester, at which upwards of 60 were present, including several former members of the staff as guests. Mr. R. A. Hepworth (a Director) presided; and among those present were Mr. C. Dempster, Mr. F. Halliwell (Manager), Mr. J. F. Halliday (Secretary), and Messrs. T. E. Priestman and J. W. Scott (representatives). The toast of "The firm" was given by Mr. J. F. Halliday, and responded to by Mr. C. Dempster, on behalf of his father. A pleasant incident of the proceedings was the presentation to Mr. Hepworth, who had recently recovered from a severe illness. It consisted of a solid silver tea and coffee service and waiter; and in asking Mr. Hepworth to accept it in testimony of the high appreciation of the staff for him, Mr. Halliwell expressed their pleasure at seeing him among them again. Mr. Hepworth suitably acknowledged the gift, and subsequently proposed the toast of the "Indoor staff." In the course of his remarks, he gave a history of the firm, for the origin of which, he said, they had to go back to a little country town in Scotland called Cupar, in Fifeshire, where Mr. Robert Dempster, sen., was born. After leaving Cupar, he took a position in the gas-works at Dundee, and thence went to London, taking his eldest son Robert with him. Mr. Dempster

From Our Own Correspondent.

. . . There is no truth in the rumour that Mr. Pierpont Morgan has acquired a controlling interest in the British gas stove and meter industry.

THE RICHMOND GAS STOVE AND METER COMPANY, LTD., are therefore still free to initiate and pursue their progressive policy of developing Day and Summer consumption.

found that the atmosphere of London did not suit him, and so he moved to Luton, where he stayed a short time, and then went as Manager of the gas-works at Elland. While there, he came to the conclusion that there was a good business to be opened up among the manufacturing towns of the West Riding of Yorkshire and Lancashire in supplying and erecting gas apparatus, because in those days nearly every small mill made its own gas; and therefore there were a large number of gas-works to cater for, in addition to the public works which supplied the towns. He commenced in partnership with Messrs. Bently and Butterfield in a small business, chiefly associated with repairs and renewals of retorts, and from that gradually passed on to contracting generally for gas plant. He (Mr. Hepworth) believed the business was established in 1855, and no doubt many ups and downs took place, inasmuch as there were a lot of obstacles to contend with, owing to the difficulty of carriage in the district, and the large number of small mills requiring a great deal of personal attention. In 1870, Mr. Robert and Mr. John Dempster commenced to assist their father in the practical management of the works, going through the business as ordinary workmen in order to qualify themselves. To this experience was due in a large measure the success they achieved in later years. At the end of 1876, Mr. Dempster took into partnership his two sons, and the firm of Robert Dempster and Sons commenced on Jan. 1, 1877. Subsequently, however, owing to the constitution of the partnership, difficulties arose, and Mr. Robert and Mr. John Dempster drew out of the Elland business, went to Manchester, and made an entirely fresh start on Jan. 1, 1885. The business was made into a limited Company on Jan. 1, 1894. Messrs. R. & J. Dempster had always had a very willing staff to assist them, and hoped the new offices would be comfortable for them. Other toasts followed, and a pleasant evening was spent.

SALES OF STOCKS AND SHARES.

At the Mart, Tokenhouse Yard, E.C., on Monday last week, Mr. Alfred Richards placed the issue of £10,000 of additional "B" consolidated stock of the Tottenham and Edmonton Gas Company which, as announced in our pages, he had received instructions from the Directors to submit to public competition. The stock carries a present dividend of 4 per cent.; and it was sold at prices ranging from £100 to £101 10s. (an average of £100 12s. 11d.) per £100 of stock, yielding the purchaser £3 19s. 5d. per cent. On the same occasion, he sold, by order of the Directors, new issues by the Southend Gas, Tendring Hundred Water, and Westgate and Birchington Water Companies. In the first case, the issue was £5000 of new ordinary stock, on which the present dividend is 5½ per cent.; and it fetched an average of £106 11s. 7d. per £100 of stock, returning £5 3s. 3d. to the purchaser. A parcel of £3300 of 4 per cent. perpetual debenture stock was disposed of at par. Some £10 "A" shares of the Tendring Hundred Water Company, entitled to a dividend of 4½ per cent., were sold at prices ranging from par to £10 5s. apiece, yielding £4 9s. 10d. per cent. The new issue of the Westgate and Birchington Water Company consisted of 500 new ordinary £10 shares (7 per cent.); and they fetched, on an average, £11 2s. each, returning the investor £6 6s. 1d. per cent. At Redcar, a few days ago, Mr. Henry Hudson offered for sale 96 £10 shares in the Redcar Gas Company. The shares, which rank for a maximum dividend of 10 per cent., fetched generally £16 2s. 6d. each —one selling for £16 5s. and the last for £16 12s. 6d. The Company have latterly paid 9 per cent. dividend.

GLASGOW AND THE CONSPIRACY ACT.

At the Meeting of the Glasgow Corporation (Police Department) on Monday of last week—the Lord Provost presiding—a proposal was brought forward that steps should be taken to determine the advisability of endeavouring to secure the extension of section 4 of the Conspiracy Act of 1875 to all departments of the Corporation.

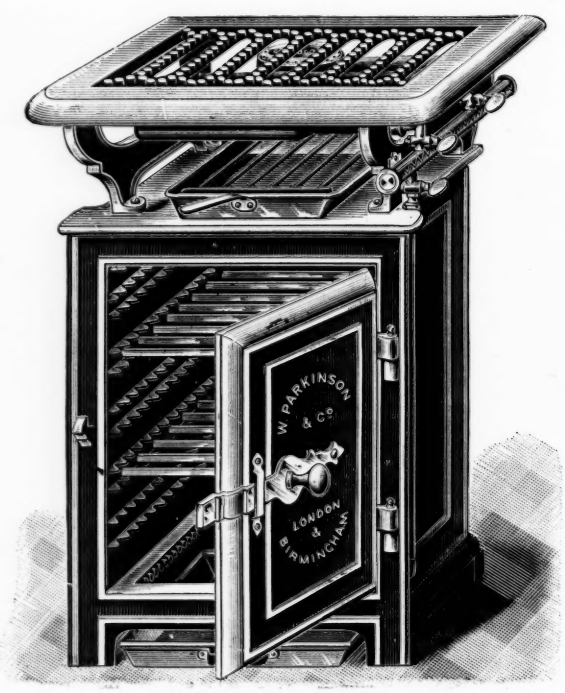
Mr. Burrell moved—"That it be remitted to the Parliamentary Bills Committee of the Corporation to consider and report as to petitioning Parliament for the extension, on an early date, to other departments of this Corporation and of other municipal authorities, of the provisions of section 4 of the Conspiracy Act, 1875." Under this Act, he said, employees must give notice of their intention to leave. The Act applied to the Gas Department of the Corporation; yet, curiously enough, it did not apply to the Lighting Department, and the result was that the streets might be left in darkness any night. Then, there was the Electricity Department, in which they had a million of capital sunk. Many of their streets were lighted by electricity; and a large number of the citizens were dependent upon it for power If, therefore, the employees of the department were to come out on strike, it would be a calamity to the city. The same thing was true of the Fire Brigade and the Tramway Department. Some members preferred to be in a position to pay off a man at once; but any loss that might be incurred by giving notice to men whom they wished to dispense with, would be trivial in comparison with the possible loss by a strike. They had recently an object-lesson in the Cleansing Department, of the danger to the health of the city by the men suddenly going out on strike. That they were able to employ other men, was due simply to the state of the labour market. Had the strike occurred eighteen months previously, the result would have been very different. He hoped the Council would see their way to pass the motion, and to remit it to the Committee for consideration and report.

Mr. Carvick-Webster seconded the resolution.

Mr. O'Hare proposed the previous question. No case had, he said, been made out to justify a departure of such a very stringent kind. Private employers had not found it necessary to have recourse to such a strong enactment. It would be ridiculous and scandalous to adopt the motion.

Mr. W. F. Anderson seconded the amendment.

PARKINSON'S



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Slot Stoves.

Strong in manufacture.
Simple in mechanism.
Sure in action.

PARKINSON AND W. & B. GOWAN, LTD.
(PARKINSON BRANCH)
LONDON and BIRMINGHAM.

Bailie STEVENSON supported the motion. He contended that it was undesirable that heads of departments should be able to dismiss employees at a moment's notice. By remitting the matter, they might get a suggestion from the Parliamentary Bills Committee which would cover the whole ground.

Preceptor GRAY was sorry such a motion had been submitted, as there was no necessity for it. He was a member of the Gas Committee when there were threatenings of a strike; but, after being reasoned with, the employees retreated from their position. Members of the Town Council, however, were among the speakers at meetings of the employees at which such threatenings were indulged in; and this was not in accordance with the dignity of a member of the Town Council. If they treated their employees fairly, as he thought they did, on every occasion, he did not believe they would find them treating the Corporation unfairly.

Bailie STEWART contended that what was proposed was a retrograde step; and wherever it had been tried, it had been a complete failure.

Mr. SCOTT said the Glasgow Corporation had an evil reputation for going to Parliament for powers which they did not require; and this was another instance. If the lighting men refused to light the gas, there would be no difficulty in getting other men to fill their places; and if the electricity went out, as it did sometimes, they could fall back on candles.

On a division, 11 members voted for the motion and 18 for the amendment. The amendment was therefore carried.

BLACKPOOL CORPORATION GAS SUPPLY.

The New Gas-Works—The Past Year's Progress.

The members of the Gas Committee of the Blackpool Corporation have lately inspected the new gas-works which were recently added to the older plant; the two sections being connected by a subway cut under the railway. On emerging from this, the party got a good view of the general plan of the works, which consist of a main road 50 feet wide, with kerbs and footpaths. On either side are the buildings—those on the south side being the retort-houses and coal-stores, while the north side is occupied by the purifier-houses and plant, machinery, boilers, and workshops. The design of the buildings is neat in character, with sufficient ornament to be attractive in appearance. The retort-house is fitted up with benches of inclined retorts; the carbonizing plant, including the coal elevating and conveying machinery, having been erected by West's Gas Improvement Company, Limited. The purifiers, which are of the latest type, were supplied by Messrs. R. & J. Dempster, Limited; and the condensers by Messrs. Clayton, Son, and Co. The tar-extractors are Pelouze and Audouin's; and the ammonia vessels are of the rotary type. The engines and machinery are all housed in buildings lined with white and coloured bricks; and the workshops are spacious and lofty. The new plant, which has been erected under the supervision of the Gas Engineer of the Corporation (Mr. John Chew) will meet the requirements of Blackpool for some time to come.

At the meeting of the Committee on Monday last week, Mr. Chew announced the result of the past year's work. It appears that in that period there was an addition of 400 consumers; making the present number about 11,000. The gas consumption went up 7½ million cubic feet; making the annual quantity 457½ millions. The total revenue amounted to no less than £75,600; and the working expenses absorbed £56,300—leaving a gross profit of £19,300, or only £500 less than last year, which established a record. For interest and sinking fund charges, the sum of £8372 wil be required; but even when this is deducted, there remains a net profit of close upon £10,950. When it is remembered that the cost of coal was high, and the returns for residuals were low, the good round sum mentioned above testifies to the careful management of the undertaking by Mr. Chew. It is due to this that Blackpool has not had to bear an advance in the price of gas like some other places—the charge being still 2s. 4d. per 1000 cubic feet.

ELECTRIC LIGHTING NOTES.

Electric Lighting for Aberavon.

Aberavon, in conjunction with Neath and Briton Ferry, has recommended the acceptance of terms with the South Wales Electric Power Distribution Company for the supply of electrical energy in bulk at not less than 50,000 units per annum, at 2¼d. per unit. For the purpose of apportionment, the three Councils are to be deemed one consumer. The Councils are to supply their own cables. This will be in addition to the proposed new gas undertaking, the application for the expenditure on which is before the Local Government Board.

Rochdale's Increasing Decrease.

The demand for electricity at Rochdale has been of a disappointing character; and up to the present time the number of customers has not reached three figures. For the year ending March 31, 1901, there was a deficiency of £1600, which was put to a suspense account. The past year's working has resulted in a loss which brings up the total deficiency to about £4000. Under these somewhat trying circumstances, the Committee are naturally endeavouring to stimulate the sale; and one of the proposals to this end consists in the wiring of houses on easy payment terms, the Corporation collecting the money.

Gas v. Electricity at West Bromwich.

The Electric Lighting and Power Committee of the West Bromwich Corporation, in a report just issued, refer to the circulars recently published by the Electric Lighting and Gas Departments of the Corporation, purporting to give the relative value and cost of electricity and gas for lighting. This matter was referred to in our "Electric Lighting Memoranda" on March 10. At the monthly meeting of the Council,

EUREKA
Ensures
EFFICIENCY

Mr. Bushell, Chairman of the Gas Committee, drew attention to certain statements, which he alleged were incorrect, contained in a circular-letter issued by the Engineer to the Electrical Department (Mr. J. H. Wray). The Engineer had been requested to submit to them a report upon the matter. In this report he states that the object of the circular in question was mainly to show the method of charging for "wiring" premises when the payments extended over a number of years. He regretted that a clerical error should have been made in taking the price of gas at 2s. 7d., instead of 2s. 5d., on a consumption of 50,000 cubic feet and upwards, and that the discount of 5 per cent. was not taken off the various amounts.

The Electric Lighting Question at Kingston.

At the last meeting of the Kingston Town Council, the Lighting Committee reported on the subject of the proposed extension of the arc lighting, to which reference has already been made in our columns. They reminded the Council that the proposal was approved as far back as 1900; that, by the authority of the Council, application was made to the Local Government Board for borrowing powers for the purpose; that the Board, after a public inquiry, sanctioned the loan; and that orders for which the Corporation were now liable were given for part of the necessary plant in June, 1901, and subsequently for other portions. Therefore, having regard to all the circumstances, the Committee could not recommend the Council to attempt to withdraw their orders for carrying out work which was decided upon after the most careful consideration. The further suggestions contained in the resolutions which had been passed by the Council, that the whole system of street arc lighting should be discontinued, the Committee considered to be impracticable, as involving unjustifiable financial sacrifice, and a serious diminution of efficient lighting. In the absence of Alderman Collings, Chairman of the Committee, Mr. Clarke (Vice-Chairman) moved the adoption of the report. Mr. Kendra Baker expressed surprise at the particularly tame ending to a matter which had stirred the town to its depth; and he thought some further action should be taken by the Committee. It was not, he said, an unreasonable request to make that an inquiry should be instituted as to the working of the electric lighting scheme—a scheme which they all knew had been pronounced defective, but which at the time of its inauguration was believed to be the best of its kind. Mr. Francis agreed with Mr. Kendra Baker that the report was a little disappointing, and more or less unsatisfactory. He was sorry the Chairman of the Committee was not present; but, if in order, he would move the appointment of a Committee to make general inquiry into the position and prospects of the electric light undertaking. The Mayor (Dr. Finny) ruled that this would not be in order. The Electrical Engineer (Mr. J. E. Edgcombe) explained that the system in use had been recommended by Mr. Arthur Preece, and was at the time the only one permitted by the Board of Trade. Since then the Board had altered their regulations; and, although the scheme might be considered a bad one now, it was not fair to Mr. Preece that statements should be made that he had wrongly advised them. Mr. Clarke having replied, the report was adopted.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Almost the only subject of discussion at the monthly meeting of the Edinburgh and Leith Gas Commissioners on Monday was that of the coal contracts for the year. It will be remembered that last year there was some displeasure at the mode of fixing these contracts, chiefly on account of certain of the Commissioners considering that they ought to have been more fully consulted—a step which was avowedly taken because the prices in the tenders got into circulation in the Glasgow Exchange within an hour of the meeting. To be plain, the members who were not consulted are engaged in the coal trade; and it has been the practice of the Commissioners, from the very beginning, that coal merchants shall take no part in fixing the contracts. I myself doubt the soundness of the practice, because I conceive it to be a pity that the Commissioners should not have the benefit of the experience of such a man as Lord Provost Steel in buying coal. This year, with a view to preventing complaints, the Works Committee resolved upon a new method of dealing with the tenders for coal. While, hitherto, the practice had been for the Commissioners to open the tenders and hand them over to the Engineer for report, his report to be submitted to a Sub-Committee, who, in their turn, report to the Works Committee, and they, again, to the Commissioners, it was resolved by the Works Committee this year that Mr. Herring should report direct to the Commissioners, each of whom would receive a copy of his report for use at the meeting. This course was followed; but there was again dissatisfaction. The chair was occupied by Provost Mackie, of Leith. The Commissioners met in private at noon to consider the report, which submitted that certain coal should be purchased, and made no mention of the coal which had been tendered but was not recommended. What took place in private I do not know; but the business was over in good time for the open meeting, which was called for one o'clock. Mr. D. Purves, the Convener of the Works Committee, said that the prices, both for coal and oil, were more favourable than they were last year. They had accepted the lowest tender for the oil. Bailie M'Kelvie, of Leith, said it appeared to him that the Commissioners had swallowed the Engineer's report "holus-bolus." They could not reasonably decide the purchase of so large a quantity of coal in ten minutes. Sir Andrew M'Donald replied that they had given an hour to it, and had gone very carefully over all the details. It was not for Bailie M'Kelvie to tell them that they had done their work in a slipshod fashion, as they had done nothing of the sort. If they had sat for a week they could not have done it better. Provost Mackie pointed out that the tenders for coal had been open for three weeks; and he did not understand why there should be such undue haste, as the market was not a rising one. Bailie Waterston remarked that he had been the cause of the change in procedure, and that he proposed it because two years ago their decision got on to the Glasgow Exchange within an hour. Provost Mackie thought it would be better if the doings

CARBURETTED WATER-GAS APPARATUS

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The Economical Gas Apparatus Construction Co., Ld.

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The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cubic Feet Daily.
BLACKBURN	1,250,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000
SALTLEY WORKS, BIRMINGHAM	2,000,000
COLCHESTER	300,000
BIRKENHEAD	2,250,000
SWINDON (New Swindon Gas Co.)	120,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000
HALIFAX	1,000,000
TORONTO	250,000
OTTAWA	250,000
LINDSAY (Remodelled)	125,000
MONTREAL	500,000
TORONTO (Second Contract; Remodelled)	2,000,000
BELLEVILLE	250,000
OTTAWA (Second Contract)	250,000
BRANTFORD (Remodelled)	200,000
ST. CATHERINES (Remodelled)	250,000
KINGSTON, PA.	125,000
PETERBOROUGH, ONT.	250,000
WILKESBARRE, PA.	750,000
ST. CATHERINES (Second Contract)	250,000
BUFFALO, N.Y.	2,000,000
WINNIPEG, MAN.	500,000
COLCHESTER (Second Contract)	300,000

	Cubic Feet Daily.
YORK	750,000
ROCHESTER	500,000
KINGSTON, ONT.	300,000
CRYSTAL PALACE DISTRICT	2,000,000
DULUTH, MINN.	300,000
CATERHAM	150,000
LEICESTER	2,000,000
ENSCHEDE (HOLLAND)	150,000
BUENOS AYRES (RIVER PLATE CO.)	700,000
BURNLEY	1,500,000
KINGSTON-ON-THAMES	1,750,000
ACCRINGTON	500,000
TONBRIDGE	300,000
STRETFORD	500,000
OLDBURY	300,000
TODMORDEN	500,000
SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
YORK (Second Contract)	750,000
ROCHESTER (Second Contract)	500,000
NEWPORT (MON.)	250,000
TOKIO, JAPAN	1,000,000
PERNAMBUCO (Brazil)	125,000
MALTON	150,000
DULUTH, MINN. (Second Contract)	300,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,800,000 Cub. Ft. SMETHWICK, 500,000 Cub. Ft. LEICESTER (2nd Cont.) 1,000,000 Cub. Ft.
GRAVESEND, 300,000 C. Ft. BROCKVILLE (ONT.) 250,000 C. Ft. NEWPORT, MON. (2nd Cont.), 250,000 C. Ft.

of the Commissioners were to get on to the Exchange still further. In his opinion, if they published all the prices they would get better terms than they did. The cheapest coal bought in Scotland was that for the Swedish Railways; and in that case all the tenders were read out. Offerers could attend and take note of the prices, both those which were accepted and those which were not. But he had over and over again heard coalmasters stating that it was of no use tendering to that Commission unless they had certain coal. Mr. Purves said the coal they purchased last year yielded nearly 5 per cent. more than the analysis led them to expect; showing that the business had been most carefully gone about, and that their selection had been fully warranted. Each coal was considered on its merits. The average price they were to pay in the forthcoming year was 12s. 6d. per ton, which was, as near as possible, the price they bought coal for in 1899 for the year 1899-1900. The quantity purchased was 232,000 tons. The Commissioners agreed to buy the coal recommended; Provost Mackie and Bailie M'Kelvie protesting.

The quantity of coal contracted for is very considerably in excess of what the Commissioners have ever hitherto taken in one year. About 180,000 tons will probably be the quantity carbonized in the year which is about to expire. I suppose that, having succeeded in getting the price down to what it was before the great rise of two years ago, the Commissioners have resolved to stock coal. This they will be able to do in their new store at the Granton works. The Commissioners have been fortunate in their purchases, which is gratifying to the community. Only the coal merchants are dissatisfied; but their dissatisfaction might have been counted upon. There will probably now be a call for a reduction in the price of gas. So far as the cost is concerned, this should be easily conceded; but there is a large capital account now upon the shoulders of the Commissioners. Is it to be taken as a forecast in this connection that the Commissioners last Monday fixed the price of gas for public lighting for next year at 2s. 8d. per 1000 cubic feet—the price it has been at during this and last year?

Last summer a very violent explosion of gas occurred in Edinburgh, by which several lives were lost. Messrs. Tod Bros., millers, of Stockbridge, had employed Messrs. W. Stewart and Co. to remove a gas-engine. In the course of the work something was done which allowed the gas to escape through a service-pipe, full bore; and the explosion was the result. One of the effects of the explosion was the blowing out of the front of a grocer's shop, kept by Mr. A. Breck. Mr. Breck sued Messrs. Tod and Messrs. Stewart and Co. for £80, as the amount of loss which he sustained. Sheriff Maconochie has this week found that the removal of the gas-engine was not, in itself, a dangerous operation; that in the work there was no necessity for, nor object in, touching the coupling joint or the inlet-pipe; and that to open them was a careless or reckless act on the part of the workmen of Messrs. Stewart and Co. He has held this firm liable in damages to the pursuer to the amount of £80. He finds that Messrs. Tod were not responsible for the consequences of the action of the workmen of Messrs. Stewart and Co.; and he has given them absolvitor.

I had understood it was settled that the Bridge of Earn Gas Company were to give up the making of gas, and were to sell gas which they were to buy in bulk from the Corporation of Perth; but it is announced this week that a Provisional Order which they have applied for, to authorize them to supply gas in the district, has been passed, and that now the shareholders of the Company will have to consider the subject either of the enlargement of the existing gas-works or the taking of a supply of gas from Perth. This question will come before the shareholders at their annual meeting on the first Saturday in June. I imagine that the arrangement with the Corporation of Perth has actually been completed, and the obtaining of the Provisional Order and the submission of the question to the shareholders are only matters of form.

A Parliamentary Committee has been sitting in Edinburgh this week considering several applications for Provisional Orders under the Private Legislations Procedure (Scotland) Act of 1899. The only one we are interested in was the application by the Corporation of Irvine for an Order empowering them to expend £104,200 upon extensions of the burgh water-works. The supply is drawn from a district considerably to the north of Irvine; the gathering-ground extending to 1200 acres. It is proposed to take in an adjoining district, extending the area to 2500 acres. In the end, the Commissioners decided to pass the preamble of the application on certain conditions.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *May* 3.

Sulphate of Ammonia.

Demand has been well sustained throughout the week, and again there has been a slight improvement in values; the closing quotations being £12 2s. 6d. per ton f.o.b. Hull, and £12 5s. to £12 6s. 3d. per ton f.o.b. Leith and Liverpool. Supplies at all points have been very scarce; and parcels offered have been readily picked up for covering purposes. There has also been considerable inquiry from abroad; but buyers' views have been below the market, and there has been very little direct business. The firmness of makers has somewhat checked forward buying; but £11 10s. per ton has been paid for October-March delivery, f.o.b. Leith.

Nitrate of Soda.

An impetus has been given to the decline in nitrate of soda by an important failure in Hamburg; and the Liverpool spot price is now down to 10s. per cwt. for fine quality.

LONDON, *May* 3.

Tar Products.

The market for pitch continues to have an upward tendency, and buyers are now coming in more freely for delivery over January-June, 1903. Some large contracts are reported to have been placed for delivery in South Wales over this period; while as regards prompt

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delivery, there is an absolute dearth of supplies. The market now seems likely to be well maintained, as most of the large makers are fairly well sold at least twelve months ahead. Pyridine continues in strong demand; and there is a considerable inquiry for forward delivery at improved prices. The market for crude carbolic remains unchanged. Consumers are still open to purchase 60's for early delivery at 1s. 11d., but will not contract at this price to the end of the year. Crystals remain in about the same position; but there appears to be a little more demand for 34-35's—one maker reporting business at 6¼d. for this quality. In Benzol, there is no actual business to report. Makers seem anxious to sell, especially for prompt delivery. There have been one or two small inquiries from the Continent, which did not result in business. As regards solvent and toluol, there is really nothing to report; no transactions having taken place. Creosote is decidedly quiet; and there are rather larger quantities offering in the North, where stocks appear to have accumulated. In anthracene, there is nothing to report. At the prices now quoted for "B" quality, it cannot pay distillers to produce it.

The average values during the week were: Tar, 15s. 6d. to 20s. 6d. Pitch, London, 42s. to 42s. 6d.; east coast, 41s.; west coast, 37s. to 37s. 6d. Benzol, 90 per cent., 8½d. to 8¾d.; 50-90 per cent., 7½d. to 7¾d. Toluol, 9d. Crude naphtha, 3d.; solvent naphtha, 9½d. to 10d.; heavy naphtha, 9d. to 10d. Creosote, London, 1¼d.; North, 1d. Heavy oils, 1⅞d. to 2d. Carbolic acid, 60 per cent., 1s. 11d. Naphthalene, 35s. to 45s.; salts, 21s. 6d. to 25s. Anthracene, "A," 1½d. to 1¾d.; "B," 1d. nominal.

Sulphate of Ammonia.

The market continues very firm indeed. The Gaslight and Coke Company now ask £11 17s. 6d. for July-September, and £11 15s. for October-December, while they cannot offer anything for May or June. In Leith, the demand continues very good, and a large business appears to have been done for forward delivery. Sales are reported at £12 5s. for prompt, and £11 15s. for June-October. The Hull market remains in the same position, and £12 has again been paid for prompt delivery. In Liverpool, the demand for immediate shipment continues very good, and £12 6s. 3d. is reported to have been paid on more than one occasion; but £12 5s. may be taken as the actual market value.

COAL TRADE REPORTS.

Lancashire Coal Trade.

The month has opened, as previously anticipated, with a more or less general downward move in prices; and this, it is now practically agreed, is to be followed by a reduction in wages of 10 per cent. The first official announcement of a reduction in price was decided upon by the leading Manchester collieries, who act to some extent independently of the Lancashire Coal Sales Association. In the West Lancashire districts, coalowners were rather disposed to hold back any official announcement of a reduction in prices until something definite had been decided with regard to the wages question; but, of course, in markets where they come into competition with the Manchester collieries, they have had to follow the downward move in the district. It is now tolerably certain a reduction in prices will become general. In the Manchester district, any official reduction has been limited to house fire qualities—representing 10d. off list rates for screened coals, and from 10d. up to 1s. 3d. and 1s 8d. in some special cases for house-fire nuts. With regard to other descriptions of fuel, the Manchester collieries have not thought it expedient to officially announce a reduction, as prices have already practically given way to much the same extent as the reduction in house-fire qualities. Taking prices all through, house-fire coals may be said to have dropped 10d. to 1s. 3d. per ton; while on steam coals, prices for the last few weeks have been gradually easing down 6d. to 1s. per ton, and there has been much the same giving way on engine classes of fuel. Best house-fire coals can scarcely be quoted at more than 14s. to 14s. 6d. per ton at the pit, seconds 12s. to 12s. 6d., common 10s. to 10s. 6d., steam and forge coals 8s. 6d. to 9s., best slack 6s. 6d. to 7s., and common sorts 4s. 6d. to 5s. In gas coals, contracts have been placed with the Liverpool Corporation for the best qualities, at 1s. per ton below the rates of last year; and there would seem to be a settling down to a basis of about 1s. 6d. for common and 1s. for best gas coals under the 1901 contract prices. The principal railway companies are still holding back from renewing contracts for locomotive fuel, except at 1s. reduction on last year; and tenders from Lancashire collieries that have been sent in at 8s 6d. per ton—which has been practically decided upon as the basis for these contracts—have been returned for revision. Many of the collieries are, however, declining to entertain locomotive fuel contracts at anything under 8s. 6d.; while the principal railway companies are holding out stiffly for the 8s. basis, and a number of the contracts are, in consequence, for the present held in abeyance. In the shipping trade, business continues unsatisfactory, with prices cut low—9s. 6d. to 10s. representing average figures for ordinary qualities of steam coal, delivered at the Mersey ports. All descriptions of coke still meet with a steady demand; and prices are being well maintained at late rates.

Northern Coal Trade.

There has been some slight increase in the demand for coals; but it is as yet below that which is usual—the exports being kept low by the late opening of the Baltic ports. There is a lessened home consumption of coal; but the exports slowly improve, and thus the output is fairly taken up. Best Northumbrian steam coals are rather steadier at from 11s. to 11s. 3d. per ton f.o.b., second-class steams are 9s. 6d. to 10s., and steam smalls are steady at from 5s. 6d. to 5s. 9d. In the gas coal trade, the settlement of the contracts for the supply of the Gaslight and Coke Company has been in progress; and though there is no official statement, it may be said that the result is generally believed to be that the coal is sold delivered at about 12s. per ton in the Thames, or, making the current freight, &c., allowance, at from 8s. 9d. to 9s. per ton f.o.b. There is now plenty of gas coal offering; but the opening of the Baltic season in a week or so will give a little more activity

TRADE MARK.

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AWARDED THE ONLY GOLD MEDAL, 1902.

NOTICE: The Vivid Mantle is Selling under the protection of Patents granted by the British Government.

The law of this country—as made clear by the Lord Chief Justice on the 8th of October, 1901, when he refused an application of the Welsbach Company for an injunction—is: The holder of a patent has as much right to trade as the holder of another patent, and neither has the preferential privilege to declare the other's patent invalid or an infringement, nor must they threaten their respective customers until the claim of infringement has been made good in a court of law.

The Court of Appeal, to whom the Welsbach Company carried the above case, confirmed the finding and judgment of the Lord Chief Justice on the 11th of November, 1901.

IMPORTANT NOTICE.

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[SEE ALSO OPPOSITE PAGE.]

to the collieries that ship a large part of their output. There is no alteration in the price of best gas coal for occasional cargoes. Coke is steady; best Durham being quoted at 17s. to 17s. 6d. per ton f.o.b., blast-furnace coke at from 15s. to 15s. 3d. at the Teeside works; and gas coke (which is still rather plentiful) at prices which show no great change, but are a little irregular.

Scotch Coal Trade.

It cannot be said that there is any improvement in trade, though the shipping figures are up, which is due altogether to the exports from Fife ports to the North of Europe having begun. Concurrently with this circumstance, and in consequence of the inquiries which are being made on behalf of foreign buyers, the prices quoted are slightly up from the previous week. It is, however, admitted by those in trade that the market is a falling one, which is confirmed by the fact that the miners' wages are to be reduced by 10 per cent. in the course of the summer. The prices quoted are per ton f.o.b. Glasgow: Main 8s. 3d. to 8s. 6d., ell 9s. 6d. to 10s. 3d., and splint 9s. 6d. to 9s. 9d. The shipments for the week amount to 195,012 tons—an increase of 5473 tons upon the preceding week, and of 2969 tons upon the corresponding week of last year. There was an increase in Fifeshire of over 20,000 tons; but there was a large falling off in the West. For the year to date, the total shipments have been 2,945,169 tons—an increase of 286,908 tons upon the same period of last year.

Stockton Gas Workers' Wages.—Mr. H. Lynas, District Secretary of the Gas Workers and General Labourers' Union, has obtained, as the result of negotiations with Mr. W. Ford, the Gas Engineer to the Stockton Corporation, an advance of 1s. 6d. per week for the service-pipe layers and excavators. This will bring their wages up to 26s. 6d. a week. The men affected, numbering about 20 or 30, originally asked for a 2s. increase.

The Southport Water-Works Transfer.—At the Williams Deacon Bank, Manchester, on Wednesday afternoon, the Southport Water Company's undertaking was formally transferred to the Joint Water Board formed under the provisions of the Act of last year. The amount of the purchase-money—£756,000, less such sums as had been deducted in respect of stock or mortgage bonds taken by the shareholders, or nearly £490,000—was handed over, and the receipt therefor, formally signed by three Directors, was given.

Southport Gas Profits.—From the draft of the Southport Corporation Gas Committee's balance-sheet for the year ending March 31, which has just been presented to the Committee, the estimated net profit, after payment of interest and sinking fund charges, is close upon £8000; but no account is taken of the deficiency of £1092 brought forward. While the Committee last year offered the Corporation £8000 in reduction of the rates, the Finance Committee demanded an extra £750. The debit-balance to be carried forward will be £820, though the deficiency on the year's working is but £70. Compared with last year, the make of gas shows an excess of about 20 million cubic feet.

East Grinstead Water Supply.—At the last monthly meeting of the East Grinstead Rural District Council, it was decided to carry out a scheme of water supply for Copthorne, Crawley Down, Turner's Hill, and West Hoathly, at an estimated cost of £13,000.

Condition of the Tyldesley Gas-Works.—At the recent annual meeting of the Tyldesley District Council, the newly-appointed Chairman of the Finance and General Purposes Committee, on taking the chair for the first time, referred to the work of the past year. He said they had had some anxious moments with regard to the gas-works; and but for the timely appointment of so capable and skilful an Engineer as Mr. Gendall had proved, serious consequences might have resulted. He had undoubtedly staved off a catastrophe, and as yet they were not through the wood. The purifying buildings had been going very fast lately, owing to subsidence, and one of their last acts was to order that they should be pulled down.

The Costs in the Poole Assessment Appeal.—Our readers may remember that after the decision was given at the Poole Quarter Sessions early last February in the assessment appeal of the Poole Gas Company (*ante*, p. 355) a question as to the apportionment of the costs was left for subsequent settlement. At the last monthly meeting of the Poole Town Council, the Town Clerk stated that the costs had been taxed, and been reduced from £480 to £429 16s. 4d., of which the actual law expenses came to £206 14s. 8d. The entire expenses, including those in connection with the valuation of the works, amounted to £724, and the arrears which the Company will have to pay towards it are £226 15s. 8d.

Ipswich Corporation Water Supply.—At the meeting of the Ipswich Town Council last Wednesday, the Water Committee reported that the Local Government Board had sanctioned the loan of £20,970 to defray the cost of the new reservoir, that the contract for the work had been signed, and that it would be commenced forthwith. The revenue account of the water undertaking showed that the rental in the year ending March 31 amounted to £16,197; the total receipts being £16,360. The expenditure (including the payment of £9279 interest on capital) came to £15,284, showing a balance of £1076. The total liability on capital account stands at £254,805; but the amount invested in the sinking fund for repayment is now £14,064.

Effect of Pumping upon Wells.—A meeting was held in the Schoolroom, Crowhurst, on Monday last week, under the presidency of Mr. J. E. Grayson, the Chairman of the Parish Council, to consider what steps should be taken in regard to the local water supply. An opinion was expressed that since the pumping operations of the Hastings Corporation had been going on, the wells of the village had been gradually drained, and the place was threatened with a drought. The matter was discussed at some length, and ultimately it was resolved: "That this parish meeting desires to call the attention of the Hastings Corporation to the fact that the general opinion of the parishioners is that the pumping-station is having a detrimental effect upon the village water supply." A copy of the resolution has been forwarded to the Town Clerk of Hastings.

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[SEE ALSO OPPOSITE PAGE.]

Cullingworth Water Supply.—At the Bingley Town Hall last Wednesday, Colonel W. Langton Coke held a Local Government Board inquiry into an application by the Bingley District Council for consent to borrow the sum of £2700 for the purpose of improving the water supply of the village of Cullingworth. There was no opposition offered; and the inquiry concluded with a vote of thanks to the Inspector.

The Tipton Urban District Council have shown their appreciation of the services rendered by Mr. Sidney O. Stephenson, their Gas Engineer, by giving him (at their last meeting) an increase of £50 per annum in his salary.

Messrs. F. C. Sugden and Co., of Leeds, have obtained contracts for semi-deep regenerator settings and ironwork from the Gomersal Gas Company and the Normanton Gas Company. The latter is a third repeat order.

The "Glasgow Weekly Herald" for last Saturday contains an appreciative notice of Mr. David Vass, the Engineer and Manager of the Airdrie Gas Company, with an account of his career and a description of his works.

Messrs. Joseph Taylor and Co., of Bolton, have received orders for their best make of solid-plate lead saturators from the Rushden and Higham Ferrers Gas Company and the Ebbw Vale Steel and Iron Company, Limited.

In the course of making conduits for the purposes of the Bow and Charing Cross electric power scheme, several iron hoops have been discovered with the rust of centuries upon them. They were the ones used for binding the wooden water-pipes laid from the New River in 1620.

The Prested Gas Indicator Syndicate, Limited, has been formed, with a capital of £2500, in £1 shares, to adopt an agreement for the acquisition of certain patents relating to improvements in apparatus for indicating the presence of dangerous gases, and to develop and work the same.

The cheap Sunlight burners and mantles which are being issued by the Welsbach Company, and to which we referred last week in the article on "The Incandescent Mantle Settlement," may be obtained, not only from the Company's Westminster establishment, but from their provincial depôts in Manchester, Birmingham, and Glasgow.

A meeting of the holders of ordinary shares in Meters Limited has been held, to consider the proposal to convert the deferred ordinary shares into ordinary shares ranking *pari passu* with the existing ordinary shares. The Chairman (Alderman J. Miles) said that for the past eighteen months negotiations had been going on between the deferred ordinary shareholders and the Directors, with the result that the Directors had come to a decision that 30,000 of the deferred shares should be given over to the Company absolutely, and that the remaining 20,000 shares should be allowed to rank as ordinary shares, and should be entitled to dividend in the usual way. The proposed change was agreed to.

The Assessment Committee of Exeter have issued a supplemental list, under which the Gas Company have the value of their offices in Southernhay raised from £238 to £255, and the rateable value of their mains from £3185 to £3500.

At the Blackshaw Beck Tar Distillery last Thursday, two men were suffocated in a tar still which they were cleaning, owing to the taps on the pipes carrying away the sulphurous acid having been left turned on, so that the gases found their way back into the still. On the unfortunate men being removed, artificial respiration was resorted to for three hours, but ineffectually.

At the meeting of the Court of Common Council of the City of London last Thursday, it was resolved, on the motion of Mr. A. C. Morton, that water should be supplied to the citizens by meter at a price not exceeding 6d. per 1000 gallons, and that the Members of Parliament for the City should be requested to endeavour to obtain the insertion of a clause to this effect in the Water Bill now in Committee.

The first annual meeting of Greenall's "Positive" Meter Syndicate, Limited, was held at the works, Kirkstall Road, Leeds, on the 25th ult.—Mr. John Tweedale in the chair. After the Directors' report and the balance-sheet had been adopted, the Managing-Director made an exhaustive statement upon the year's progress; and it was considered by the shareholders to be very satisfactory. After the meeting they inspected the works under the guidance of the Chairman and Managing-Director.

Some of the boys of the Ocker High School recently paid a visit to the Tipton Gas-Works, accompanied by their master, to receive practical instruction in the manufacture of coal gas. They were received by Mr. Sidney O. Stephenson, the Gas Engineer and Manager, who showed them round the works, and fully explained the various processes and appliances in use. The boys were much interested in all they saw, and before leaving partook of refreshments, including cakes, which had been cooked at the recent cookery exhibition.

The third ordinary general meeting of Meldrum Bros., Limited, was held on Wednesday, in Manchester. The Chairman presented the Directors' report and the balance-sheet for the past year, which was unanimously adopted, including the declaration of a dividend on the ordinary shares at the rate of 8 per cent. per annum. The Chairman stated that satisfactory progress was being made in connection with the large new works which the Company are building at Timperley, and expressed the hope that they would be in full operation before the close of the year.

It will be seen from an announcement which appears in our advertising pages to-day that Messrs. Ashmore, Benson, Pease, and Co., of Stockton-on-Tees, have recently made large additions to their works. The most modern machinery and labour-saving appliances have been adopted, including electric cranes and driving throughout. The firm are in a position to turn out first-class work at lowest prices, and in the shortest possible time; and they have just secured a large order from the Croydon Gas Company. A great advantage is that, under the new arrangements, all the firm's work can be done under cover.

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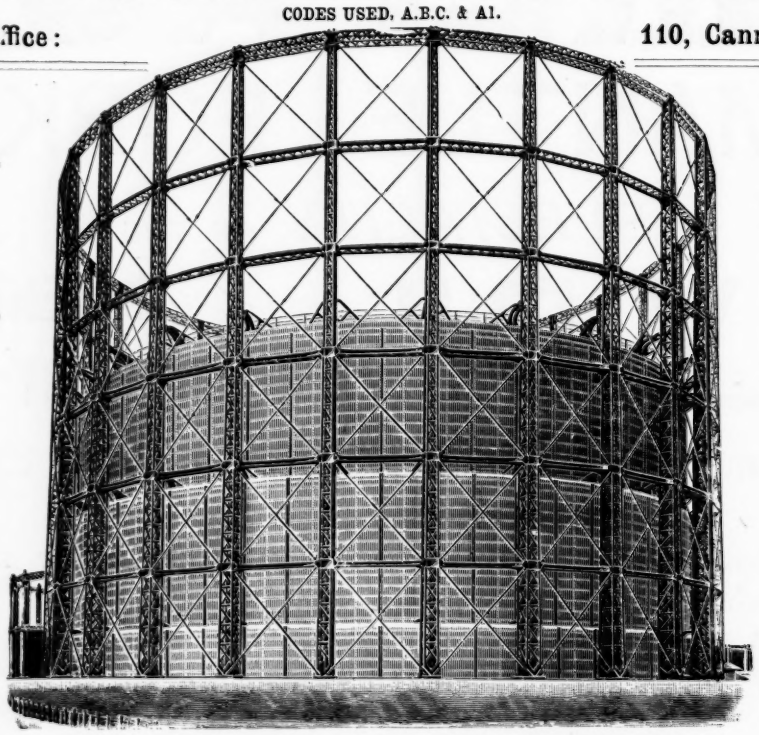

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